American Machinist

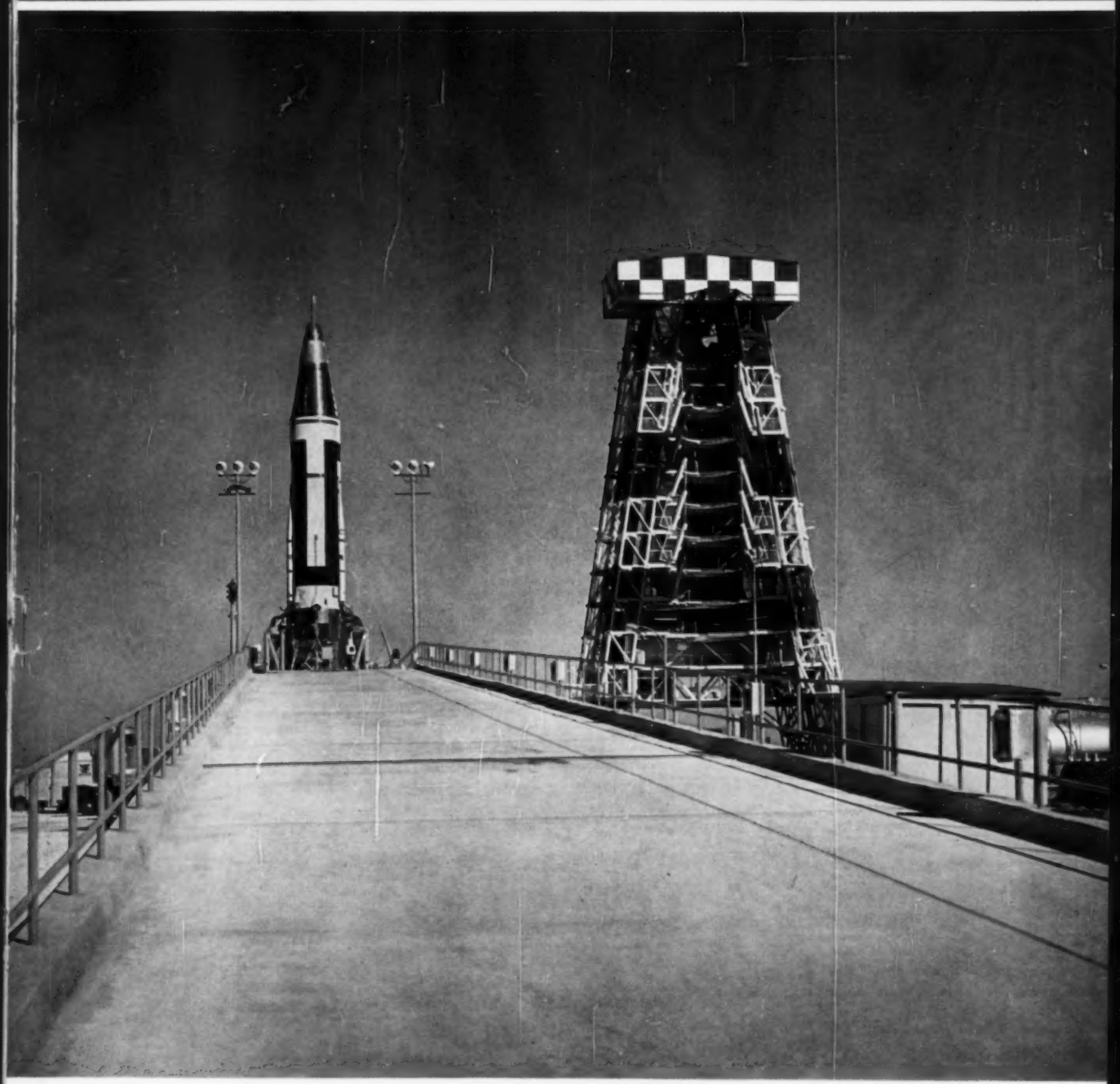
JULY 14, 1958 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Adjustable-speed Drives

A SPECIAL REPORT

Page 97



• **Convair tests missile components at Point Loma**—page 94

it's mainly a matter of TIMING!

Knowing WHEN to replace a machine saved one manufacturer $16,794 a year

TAKE ANY machine in your plant. You know that some day it will have to be replaced. But *when?* That is the big question. And wrong answers probably cost American Industry millions of dollars every year.

For any machine, there is one optimum replacement time—the time when it can be replaced with a new one at *lowest overall cost*. And it can't be determined by haphazard methods. Guesswork, intuition or rule-of-thumb computations will be wrong most of the time. And even some obsolescence formulas are not above suspicion. But you can put a dollar sign on every variable involved, and come up with a precise figure that will mean a major saving in production cost and capital investment.

Heald sales engineers are well experienced in making obsolescence studies to determine when a machine should be replaced. Sometimes it is found that replacement is overdue. And often it can be shown that next year or the year after would be better for the customer. If you would like help in planning your replacement program, or want to confirm your estimates for a particular machine, just call in your Heald engineer. Similar studies have pointed the way to many important savings.

For Example: A manufacturer of aircraft instruments had been using a 5-year-old precision lathe to perform boring, turning and facing operations on instrument cases. But when this was replaced with a new Heald Model 0 Unit-Type Bore-Matic like that shown at the right, operating costs for the same production were immediately reduced by over 78%. In addition, the elimination of a separate burring operation and reduced assembly time made further important savings, as indicated by the cost analysis below.

	Old Machine	New Machine
Parts per hour	4.3	20
Parts per year (Req'd. Prod.)	10,000	10,000
Direct and Indirect Labor, per year	$20,349	$ 6,055
Scrap Losses, per year	$ 500	$ 300
Annual Maintenance Cost	$ 600	$ 300
Annual Operating Cost	$21,449	$ 6,655
Basic Annual Saving, New Machine		$14,794
Additional Saving from elimination of separate operation		$ 500
Additional Saving from reduced assembly time		$ 1,500
Total Saving Per Year		$16,794
Return on Investment for New Machine		84%

YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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TRENDS

Spot News . . 65
Washington . . 67
Detroit . . 69
Aircraft and Missiles . . 71
Machine Tools . . 73
Materials . . 75
What's Ahead . . 77
News Report . . 86
Field Report . . 146

Departments...

Letters . . 60
Editorial . . 81
Practical Ideas . . 116
Talking Shop . . 113
Memos . . 113
New Equipment . . 119
Names . . 159
New Films . . 162

contents for July 14, 1958

VOLUME 102, NO. 14

Extrusion cuts production time frome 3½ hr to 5 min . . . Raytheon has perfected tooling to make intricate cavities by a fast production process. *By Anderson Ashburn*. 83

Heat coolant to hold tolerances . . . Light finish grinding of close tolerances parts can result in rejects unless work and gage are kept at same temperature by control of coolant temperature. 88

Tests for space-age components . . . The Atlas missile is tested by its individual parts in a procedure typical of the inspection requirements in this new field. *By R S Campbell, Convair-Astronautics*. 94

Lazy-Susan worktables cut assembly costs . . . By replacing straight benches with rotary-indexing worktables, savings are made in many assembly operations. *By Ben C Brosheer*. 96

Shop-built machines solve bending problems . . . Aluminum, stainless, and copper tubing, both plain and finned, can be handled. *By Michael W Maloney, Walter Kidde & Co.* 114

SPECIAL REPORT NO. 462

How to choose and use electrical adjustable-speed drives . . . The fundamentals of electric and electronic drives and the essentials of selection and operation to get peak performance. *By E H Dinger, P A Herrman, General Electric Co.* 97

REFERENCE BOOK SHEETS

Geometric and Positional Tolerancing, VII . . . Information based on a set of lectures developed to explain this complex subject. *By Walter H Harrington, Avco Manufacturing Corp.* 107

Extended-center helical gears, I, II . . . Inspection with pins is not covered by the usual tables. Here is a systematical method for these gears. *By Charles Tiplitz, Chalon.* 109

American Machinist chips

Missile Testing . . . Not all missile testing is done at that highly publicized base at Cape Canaveral. Firing is the final test of any missile, but many tests precede that payoff, and they are as much a production problem as is quality control in any metalworking plant. You'll find a discussion of how Convair tests the Atlas at Point Loma in the article on page 94, by R S Campbell, chief of the test labs at Convair-Astronautics.

Heat Coolant? . . . Yes, in these days of ultra precision, if it is necessary to hold tolerances. To find a case where it is, and what Pratt & Whitney Aircraft did about it, see the article on page 88.

Adjustable-speed drives, which many people call variable-speed drives, can be either mechanical or electrical. The electrical ones can be either electric or electronic. The subject is complex and important today. Our Special Report in this issue concentrates on the factors involved in choosing among the electrical types and contains advice on how to get peak performance from them. See page 97.

Homestretch . . . The 8th *American Machinist* Inventory of Metalworking Equipment is moving into the final stages of data collection. Already we have more individual plant reports than ever before, but we won't be satisfied unless we have yours. This truly mammoth study, made every five years, provides the only source of detailed information on the amount, kind, age, and distribution of metalworking equipment in the United States. As such it serves many uses to both industry and government. If you know the report on your plant is in process, please do what you can to speed it up. If you aren't sure whether your plant has reported yet or not, drop a line to Tom Johnson, associate editor of *American Machinist*, 330 W 42nd St, New York 36, NY, and he can quickly tell you. Time grows short, however, and we need you.

Coming . . . *AM* for July 28 will include a story on how a part was redesigned to speed press operations, some advice on the selection of grinding oils, further examples of automatic loading, plus a number of other articles and all the regular departments.

Cover . . .

The Atlas missile towers above Convair's test facilities at Point Loma, Calif. See details at left.

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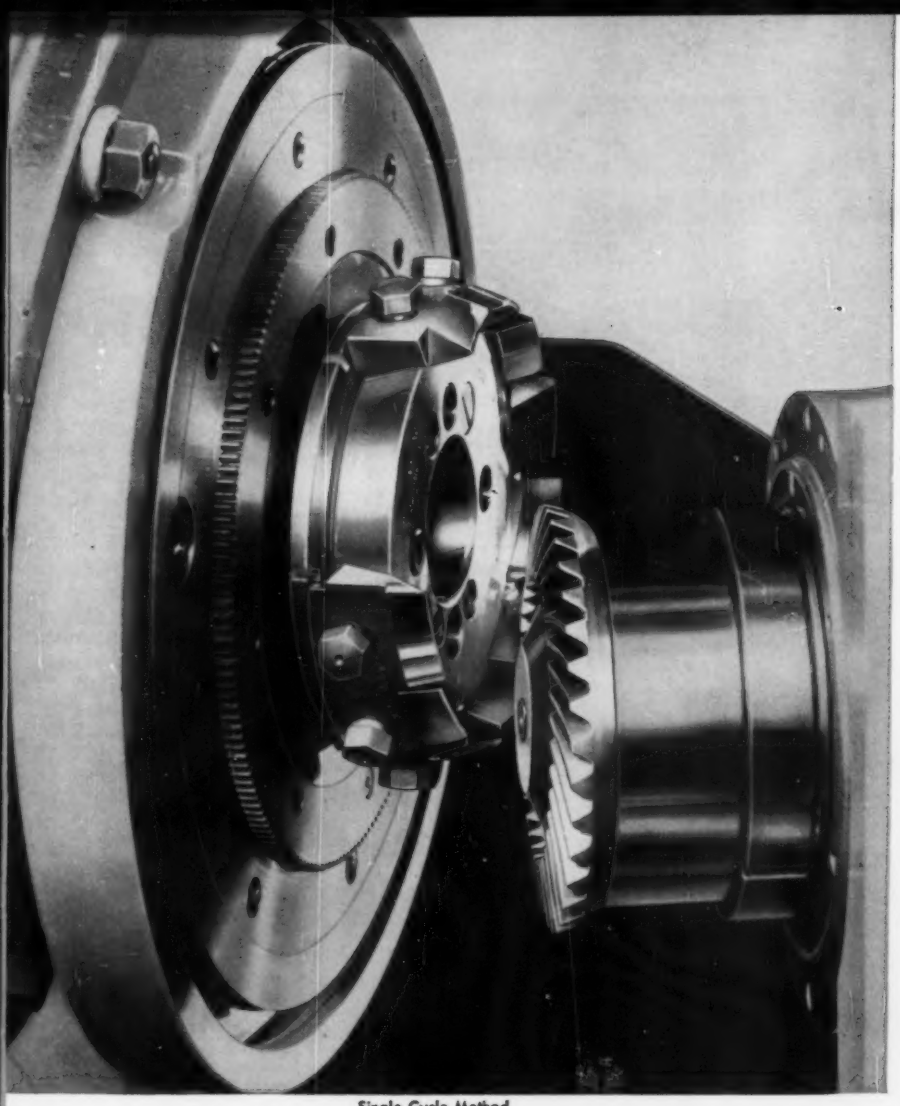
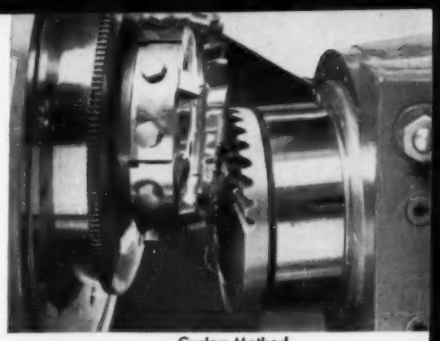
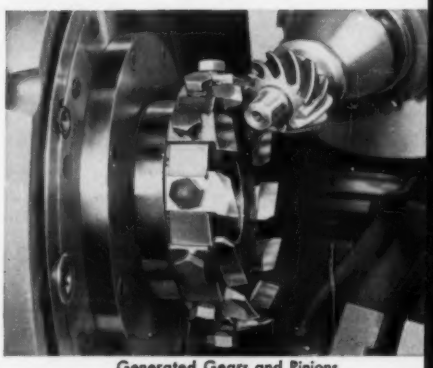


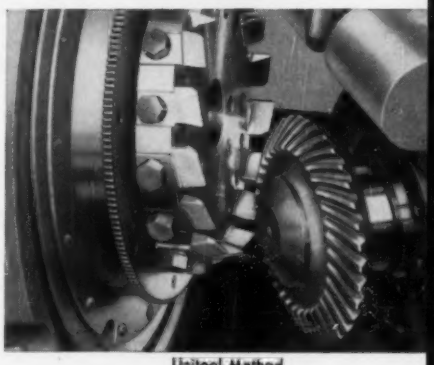
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½" diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18" diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 29 Hypoid Generator, cuts gears up to 33" diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

*Trademark

72

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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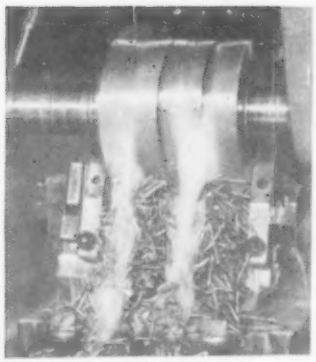
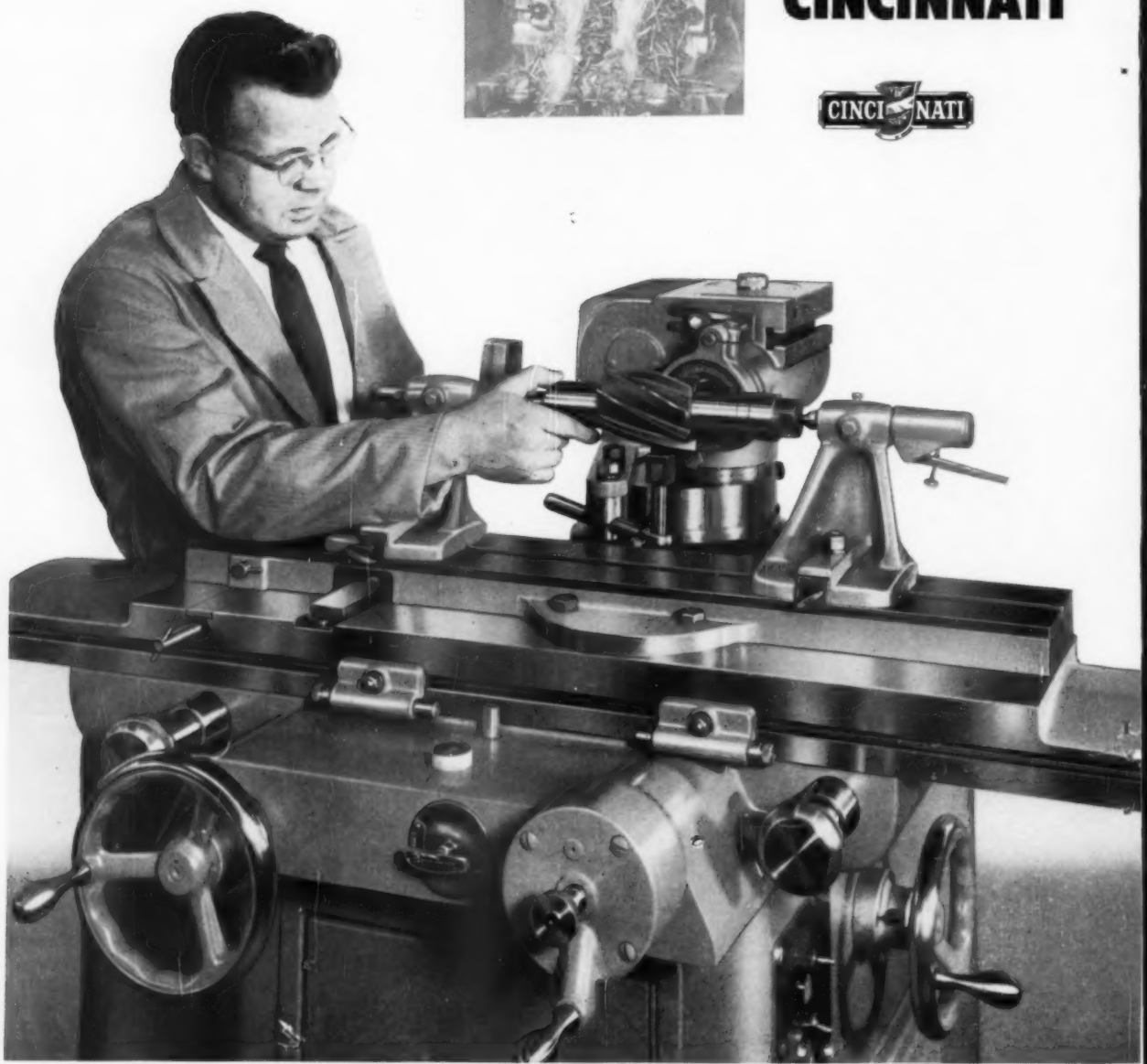
WHEREVER CHIPS ARE CUT...



...they're cut

CINCINNATI

CINCINNATI



Helical cutters are accurately ground in the twinkling of an eye on CINCINNATI No. 2 Cutter and Tool Grinding Machines.

CINCINNATI®

Knee Type Milling Machines • Bed Type Milling Machines

faster with cutters ground on

Cutter and Tool Grinders

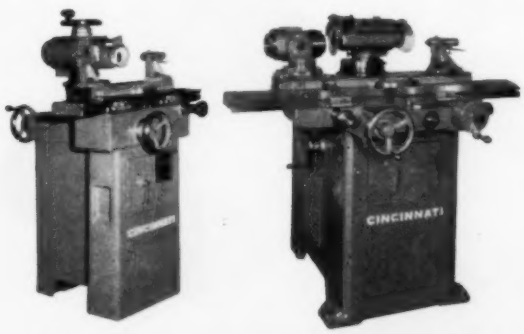
• Cutter grinding puts life into every metal cutting operation. And as the speed of metal cutting increases, the stature of cutter grinding grows in importance. Cincinnati has long recognized this relationship, and actively promotes efficient metal cutting through research and by building the world's finest Cutter and Tool Grinders. ¶The Nos. 1 and 2 sizes are designed to accurately and quickly grind a variety of cutters such as helical, dovetail, keyway, circular saws, reamers, end mills, planer tools, etc. Quite naturally, the foregoing variety of cutters requires a high degree of versatility, and Cincinnati has it.

Ball bearing anti-friction table slide . . . eccentric swivel mounted wheelhead for 360° positioning and extra range . . . duplicate four-position operating controls . . . large graduated clearance setting dials . . . "Tange Bar" convenient taper setting device . . . dozens of attachments and accessories.

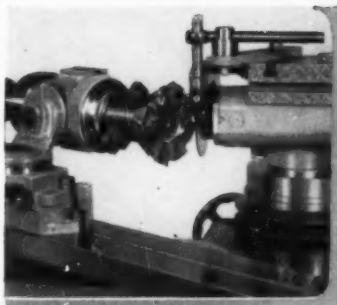
Grind your cutters on CINCINNATIS and see cutter maintenance cost decrease and metal cutting efficiency improve. Get the full story in catalogs No. M-1852-2 and No. M-2004. Brief specifications in Sweet's Machine Tool File.

Brief specifications

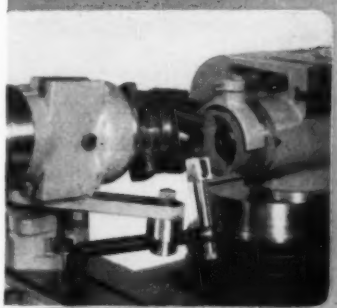
Size	No. 1	No. 2
Swing over table	8"	10"
Length of work, between tailstock centers	15"	27"
Range: longitudinal	10"	16"
cross	4½"	8"



CINCINNATI CUTTER AND TOOL GRINDERS
No. 1 *(left)* Catalog No. M-1852-2
No. 2 *(right)* Catalog No. M-2004

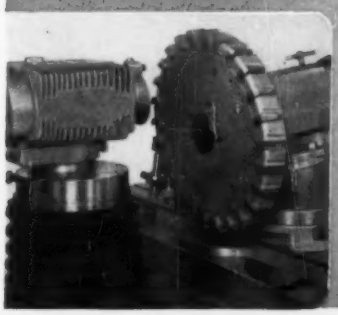


Dovetail cutters are ground with the swivel table disengaged.



Shell end mill cutters are ground in position on their arbors.

Taper reamers, most demanding of all, are given the highest quality grind on a CINCINNATI.



Heavyweight 18" diameter face mills can't hamper the smoothness and ease of table traverse.

Die Sinking Machines • Cutter and Tool Grinders

THE CINCINNATI MILLING MACHINE CO.
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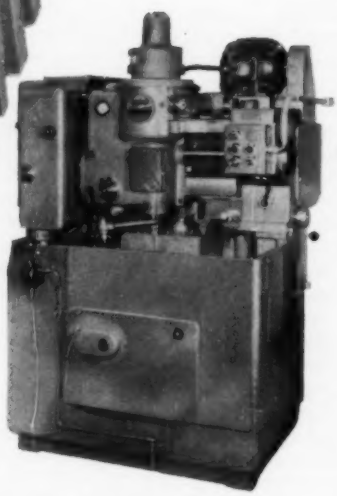
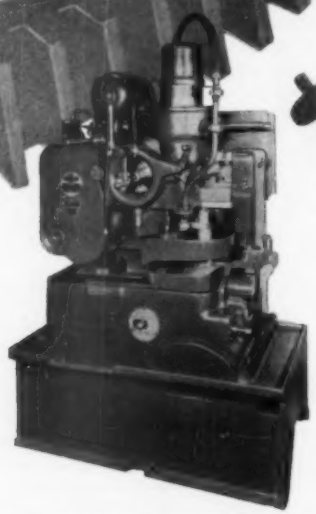
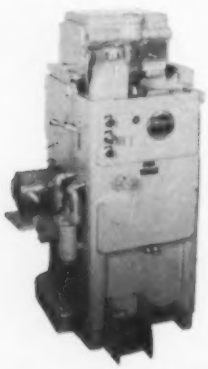
In Every Size Range ...Cut Costs with



FELLOWS NO. 4GS

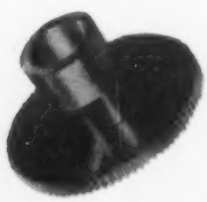
Among the products for which gears are cut on the 4GS are automatic transmissions, gasoline motors, hoist and well drilling equipment, computers and aircraft reduction gear units.

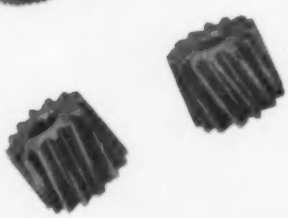




FELLOWS 7A-TYPE

Gears cut on the 7A are used in textile machinery, servo-mechanisms, washing machines, cash registers, lawn mowers, machine tools and motorcycle engines.



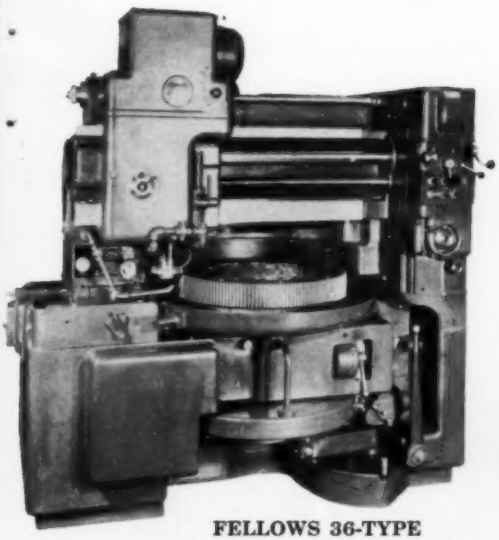


FELLOWS 3-INCH FINE-PITCH

Used to cut gears for computers, bomb director and gun fire control systems, aircraft and flight control instruments, cameras and electro-mechanical mechanisms.

THE PRECISION LINE

Fellows Gear Shapers



FELLOWS 36-TYPE

Gears for construction equipment, textile machines, mining machinery, industrial truck transmissions, tractors, cranes and hoists are cut on this machine.

FELLOWS 120-INCH

Large, heavy duty gears for power shovels and other road construction equipment, heavy cranes, gun segments, tank turrets and winches are cut on the 120-Inch.

Modernizing cuts costs. In many plants the speed and versatility of new Fellows Gear Shapers has lowered gear production costs by more than a third and repaid the investment in just a few years.

Gear Shapers are ideal for many non-involute shapes too, such as internal and external splines, cams, clutches and nearly every other conceivable shape. Modifications to the Gear Shaper permit rapid, economical production of oval or elliptical gears. Fellows machines are available for either full- or semi-automatic operation for high speed, long-run production with a minimum of operator attention.

Your Fellows representative can show you where and how new machines from Fellows' Precision Line can lower your costs for small lots as well as for long production runs. Ask him for the facts.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
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Fellows *Gear Production Equipment*

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For steelcutting . . . trim costs with Carboloy® Extra-Performance Grades 330, 350, and 370, and low-cost, General-Purpose Carboloy 78 and 78B carbides

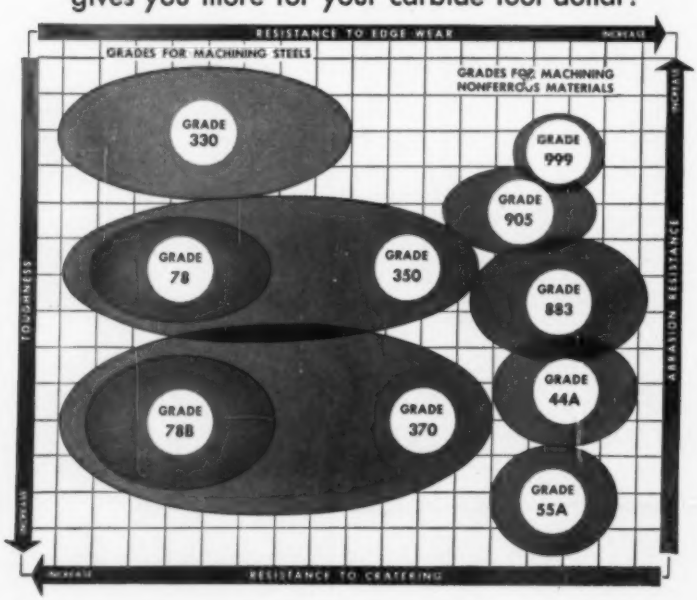
Some steelcutting jobs call for extra-tough, extra-performance carbides. Others can only be handled profitably with low-cost, general-purpose carbides. That's why we make them *both*.

Where you need increased machine productivity and have long production runs to keep cost-per-piece low—use Carboloy Extra-Performance Series 300 carbides. Their added strength and stamina handle jobs ranging from heavy roughing to high-speed finishing . . . at a unit cost and rate no "premium" carbide on the market can beat.

But, for general-purpose steelcutting jobs that don't require the Extra-Performance carbides, use Carboloy Grades 78 and 78B. Their top-notch performance, at low initial tool cost, will keep your machines operating profitably.

Chances are, your plant should be using *both* grades. Your local Authorized Distributor of Carboloy cemented carbides can deliver tools, blanks and inserts you need . . . in a hurry.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!



YOUR CARBIDE TOOL DOLLAR?

For nonferrous materials . . . boost production rates with Carboloy® cemented carbides performance-matched to your machining jobs

Aluminum, titanium, super alloys, wood—all have machining peculiarities that raise cain with production schedules and tool costs. That's why we make *five* job-tailored Carboloy cemented carbides for cutting these materials.

With these five grades (see chart, at left), you can get the one with exactly the right combination of shock resistance and wear resistance to match your job—whether heavy, interrupted cuts, or precision finishing.

Because you're using performance-matched carbides with consistent metallurgical quality, you can schedule heavier production loads . . . and you will get this increased output at lower tool-cost-per-piece.

Your local Authorized Carboloy Distributor has complete stocks of tools, blanks, and inserts in these five grades. A phone call to him today will get your machines humming faster tomorrow.

For more information on Carboloy Extra-Performance and General-Purpose carbides, or nonferrous material carbides, write: Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Road, Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

expensive part thread-rolled and burnished

. . . with no spoilage

Specifications required that threads be rolled and thread relief burnished after heat treat on this highly critical, highly stressed aircraft jet engine mounting made by Liston Grinding Company, Tonawanda, New York.

Both operations were performed between centers on the same LANHYROL Machine with the same work-holding fixture. The plastic deformation and cold working of the thread rolling process vastly improved the tensile strength and fatigue resistant properties of the part. The material was 4340 steel at a minimum hardness of 40 Rockwell "C" to assure a tensile strength of 180,000 to 200,000 PSI.

Prior to the LANHYROL operations, each part contained many hours of manufacturing time. Because of this accumulated cost, it was essential that burnishing and rolling be accomplished with minimum scrap. Of the entire lot of parts rolled to date, not one has been spoiled in either rolling operation, including those used in setting up the machine.

Neck diameter and radius adjacent to the thread had to be burnished

The roll-burnishing operation (figures 2 & 3) preceded the threading operation and was for the purpose of increasing the fatigue resistant properties of the material by cold working plus the reduction of any stress-raising grinding tool marks. The surface burnished had to include the entire .150 radius, the .6954 neck diameter and the .02 radius adjacent to the thread. First, the surfaces were ground to a surface finish approximating 20 micro-inches before roll-burnishing. Then roll-burnishing was performed at a roll-pressure of 25,000 pounds to result to a 4/6 micro-inch finish. The workpiece ran at a speed of 480 RPM and the dies were in contact with the workpiece for 1.5 seconds.

All threads produced with a pitch diameter variation of less than .0005"

After roll-burnishing, the ¾" — 16 UNF— 1.03" long threads were rolled (figures

figure 1

Jet Engine Mounting— burnished and thread rolled by the LANHYROL Machine

528C

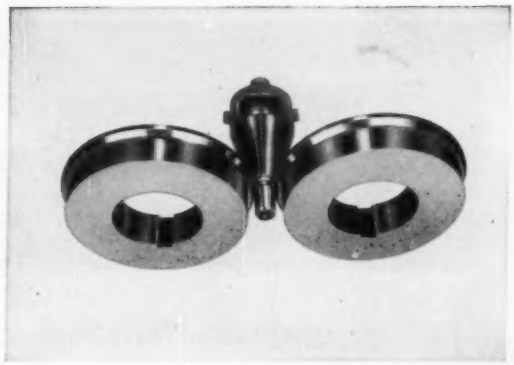


figure 2

Simulated machine set-up for roll burnishing

4 & 5) at a workpiece speed of 1320 RPM. The thread rolling dies were in contact with the workpiece for only .24 of a second. *All threads were produced to near-perfect concentricity with a pitch diameter variation of less than .0005".*

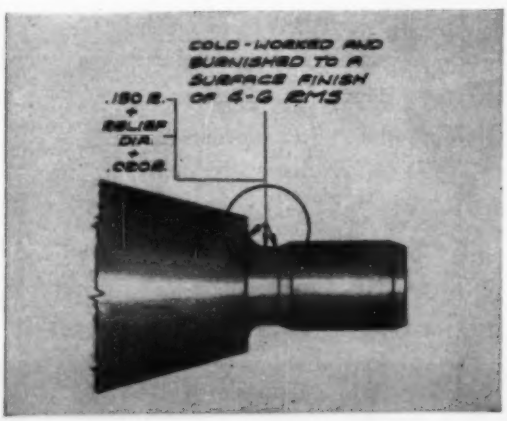


figure 3

Drawing illustrating roll-burnishing operation

High Production • Accuracy
Wide Range • Flexibility

This LANHYROL operation is but one of the many producing outstanding results.

LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Production data from these installations prove the unequalled productivity and dependability of this versatile machine.

The LANHYROL Thread Rolling Machine produces strong, accurate threads of excel-

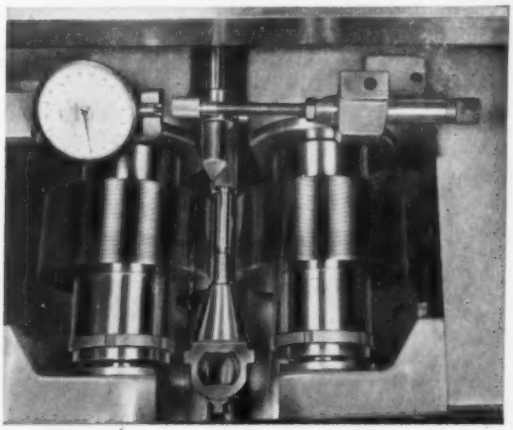


figure 4

Machine set-up for thread rolling

lent finish by any one of four rolling methods —Thrufeed, Infeed, Continuous or Reciprocal. It will thread all diameters from "0" to 3", producing left and right hand threads of all types, including UNC, UNF, Acme, worm and many special forms.

Additional information on request — please send specifications and ask for Bulletin E-60.

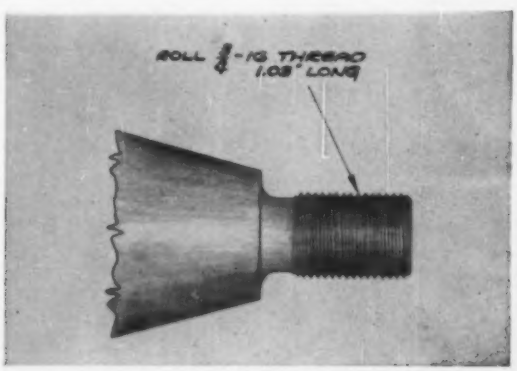


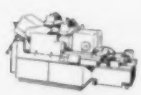
figure 5

Drawing illustrating thread rolling operation

Threading Machines

Die Heads—Rotary & Stationary

Taps—Collapsible & Solid Adjustable


Centerless Thread Grinding Machines

Thread Rolling Tools

Thread Rolling Machines

Why Landis grinders with Microsphere

exclusive Microsphere spindle bearing

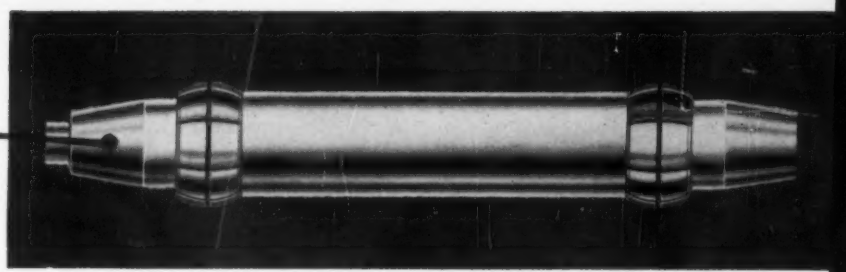
plain grinders	universal grinders	centerless grinders
4" to 36" swing *18" to 240" between centers* *3 to 30 hp wheel drive*	*10" to 48" swing* *28" to 120" between centers* *1½ to 7½ hp wheel drive*	*1/16" to 6" work diameter* *15 to 25 hp wheel drive*

LANDIS

precision grinders

bearings give precision *plus* production

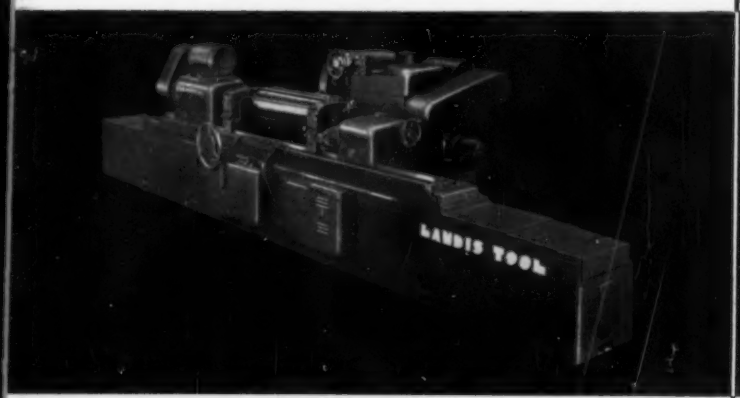
exclusive rigidized wheel spindle



Here's why Microsphere bearings *and* rigidized spindle give precision *plus* production.

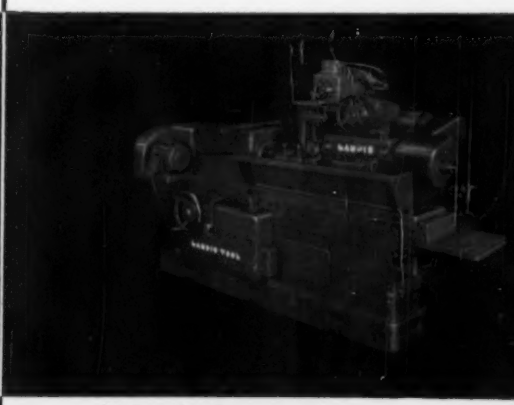
- heavy cuts to close tolerances because of bearing and spindle rigidity
- closest running clearance gives fine finishes and quick positive sparkout
- trouble-free operation with one-piece bearings and simplified construction

roll grinders



10" to 60" swing
48" to 288" between centers
5 to 40 hp wheel drive

special purpose grinders



multiple wheel, concentric,
automotive types:
crank, cam, piston, valve

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

The big 3 inch

G&L 300-T table-type horizontal boring, drilling and milling machine

Here's America's most versatile 3" dia. spindle horizontal machine! With truly exceptional efficiency it bores, mills, drills or taps. Generous bearing surfaces provide maximum rigidity to give the 300-T outstanding ability to consistently produce excellent finishes with precision accuracy *through the entire machining range.* For further facts, call your nearest G&L representative or write direct.

FEATURES THAT CAN PRODUCE MORE PROFIT FOR YOUR SHOP:

- **45 spindle speeds, 36 spindle feeds** provide exact choice for any type tooling or work material.
- **Full length precision scales and verniers** easily read to .001" for headstock, table, saddle and end support.
- **Hardened bed and saddle ways** provide longer life to maintain higher machining accuracy.
- **Rotary selectors and rotary reading dials** for fast, accurate selection of feeds and speeds.
- **23 milling feeds.** Ideal for a broad variety of milling.
- **Independent operation;** all units operate independently in either direction, simplifying machine handling and control.
- **Automatic electric positioning device** accurately controls distances between machined holes. Makes possible positive machine settings for boring operations repetitive to .0002". Ends pre-layout and manual adjustments. (*)
- **Improved measuring device** for headstock, table and saddle provides extreme accuracy in positioning with readings to .0001". (*)
- **Exclusive G&L "Lubri-Cool" system** assures accurate operation under any temperature condition. (*)

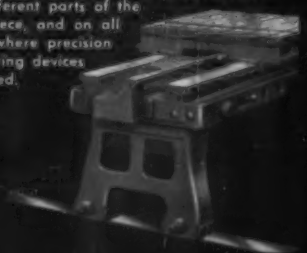
(*) Optional equipment

G&L *and* HYPRO DIVISION

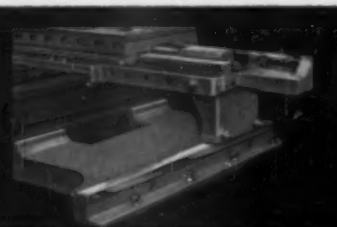
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN G-94

Builders of the world's finest heavy-duty Table, Floor and Planer Types Horizontal Boring, Drilling and Milling Machines; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring and Turning Mills; Spar and Skin Milling Machines; VARIAX Milling Machines and NUMERICORD-numerical continuous path tape controls.



Saddle supports and auxiliary runways recommended for greatest accuracy where operations are performed progressively on different parts of the workpiece, and on all work where precision measuring devices are used.



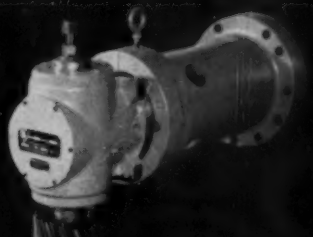
Over-the-floor type auxiliary runways provide complete location flexibility. Especially designed to meet problems created by foundation limitations.

Built-in rotary tables eliminate multiple work setups. Two sizes: 30" x 36" and 36" x 42"

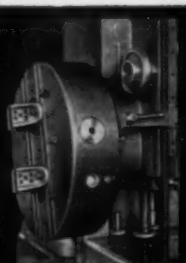
FAST, ACCURATE, VERSATILE, PRODUCTIVE

G&L Model 300-T table-type Horizontal with automatic electric positioning device completes 47 distinct operations in less than three hours on this complex gear case housing. It bores, drills, mills, counterbores and reams. The 300 Series machines are available in two models with a wide range of specifications: Standard Model 300-T and Model 300-RT machine with a built-in rotary table.

Combination plain, hand and power feed rotary table — fast, accurate hand or power indexing. Available with round, square or rectangular platens in various sizes.

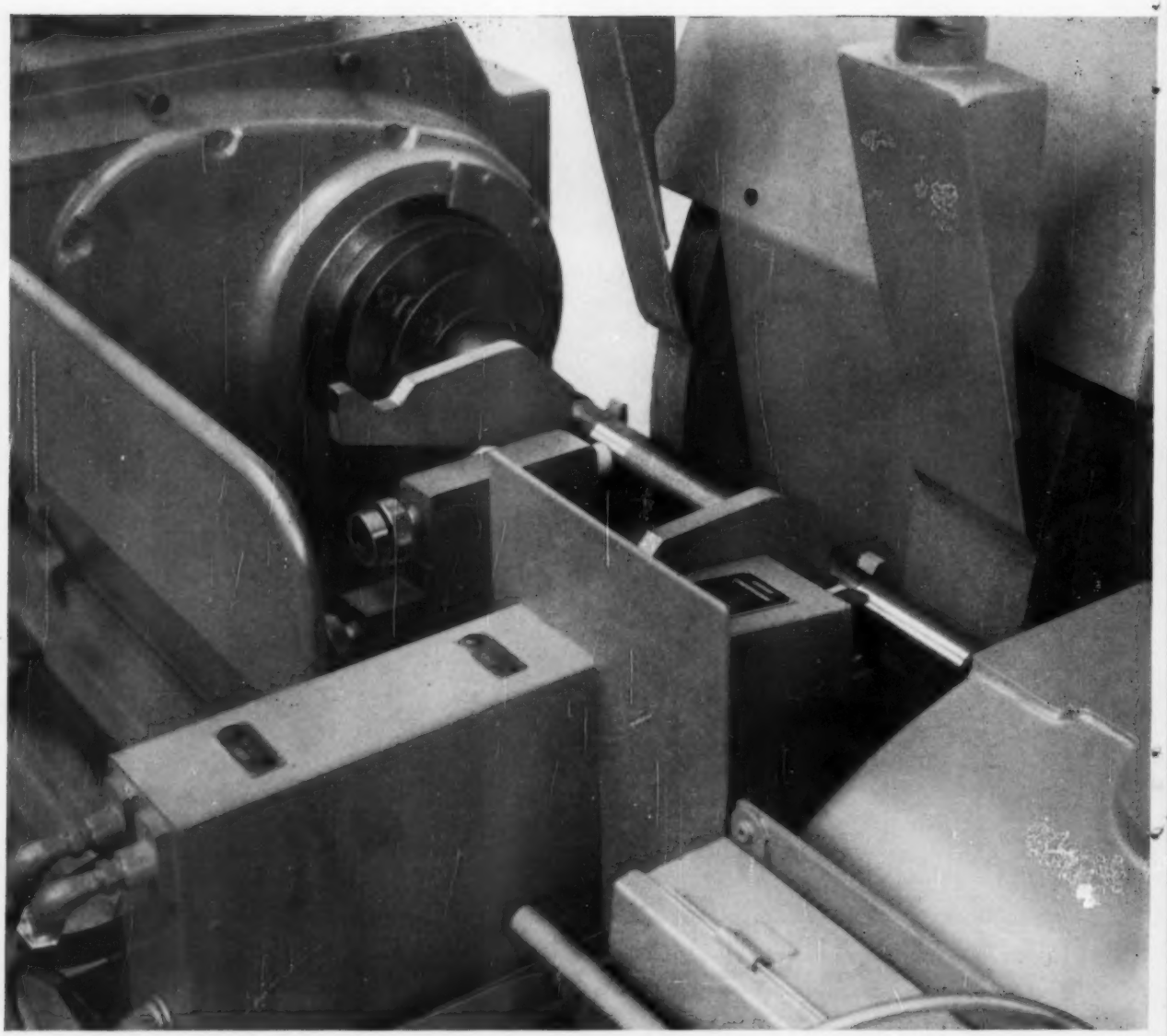


Angular milling attachment operates at right angles to machine spindle. Unusual flexibility for machining hard-to reach surfaces.



Continuous feed facing and boring heads used separately or in combination with other attachments or accessories for turning, facing, threading, back facing, grooving, etc. Telescopic right angle and facing tool holders, and high speed grinder are also available.

2 widely spaced



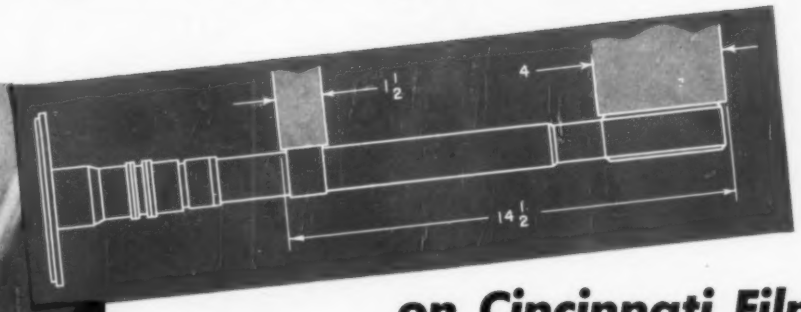
Two different diameters spaced 9" apart are automatically ground and sized with the aid of a jump type automatic air-electric gage sizing unit. The machine is a CINCINNATI FILMATIC 10"R x 36" Plain Hydraulic Grinder.

FILMATIC

CINCINNATI®

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING
ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES •

diameters ground simultaneously



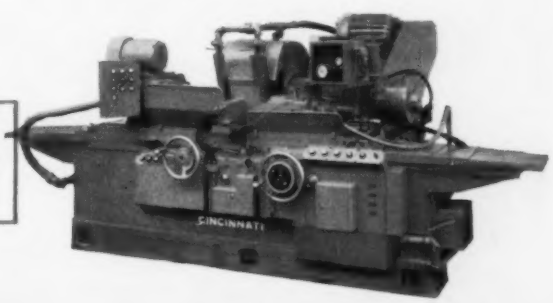
Drawing of part. Part name, output shaft . . . Stock removal .010" . . . Material, steel . . . Estimated production, 104 per hour @ 80% efficiency.

on Cincinnati Filmatic 10" R Plain with JUMP type gage sizing

Most promising way to reduce precision grinding costs . . . combine operations. This approach to cutting cost is especially attractive when the machine is basically standard, like the CINCINNATI FILMATIC 10"R Plain Grinder illustrated here. It precision grinds and automatically sizes two widely spaced diameters at the same time. ¶ Cincinnati Grinding Specialists incorporated several cost-reducing features in this machine, including a new type of horizontally mounted automatic air-electric gage sizing unit. At a predetermined point in the grinding cycle, usually when about .007" grinding stock remains, the "jump" mechanism automatically advances and the contacts engage the work. The gage mechanism automatically retracts after the work is ground to size. Wear and maintenance of the sizing elements are thereby greatly reduced. ¶ Other equipment contributing to the machine's excellent performance record include push-button dual rate automatic infeed; loading cradles with a parking place for the next part; push-button behind-the-wheel profile truing; automatic gap eliminator; hydraulic footstock. Of course, standard FILMATIC grinding wheel spindle bearings are the deciding influence in grinding with spaced wheels spanning 15" up to 9" combined wheel width. ¶ This equipment typifies Cincinnati's advanced thinking in supplying machines completely tooled up to meet today's production and cost requirements. Our Specialists can help you, too. Ask for a visit by one of our field men.

CINCINNATI

CINCINNATI FILMATIC 10"R x 36" Plain Hydraulic Grinder, equipped for push-button operation. Equipment of this type is engineered by Cincinnati Grinding Specialists.



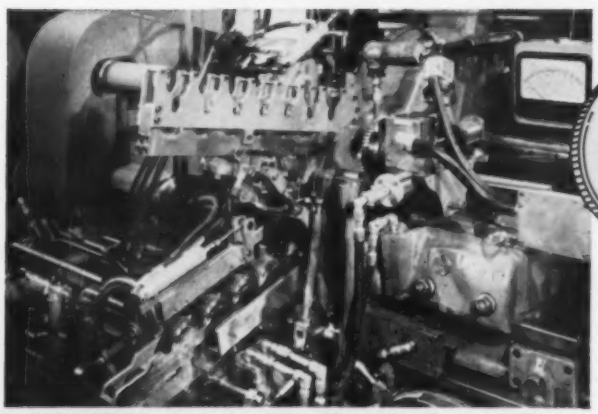
MACHINES • MICRO-CENTRIC GRINDING MACHINES
CHUCKING GRINDERS • CENTERLESS LAPPING MACHINES

Grinding Machine Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

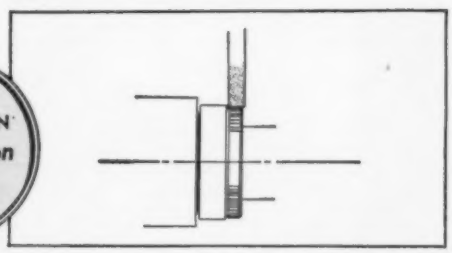
The more you grind the more you save with Norton...

cost-cutting automatic operations

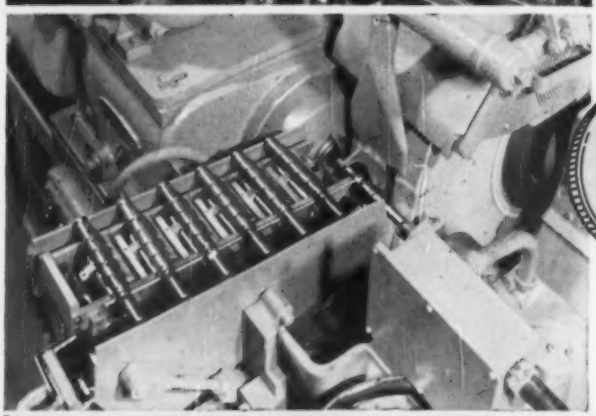
Typical automatic features on Norton grinders



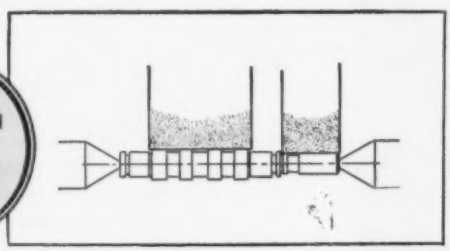
SAVINGS ON *Transmission Gears*



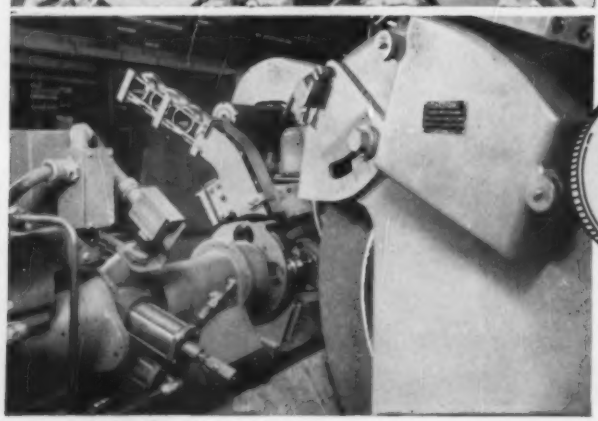
In a Type CTU Cylindrical Grinder arranged for completely automatic loading, grinding, and unloading of transmission gears, the part is held on a chuck and grinding cycle is terminated by an automatic air-electric grinding gage that signals when work is to size.



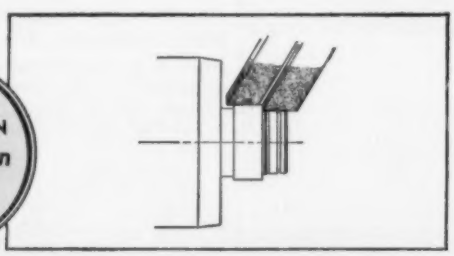
SAVINGS ON *Valve Pistons*



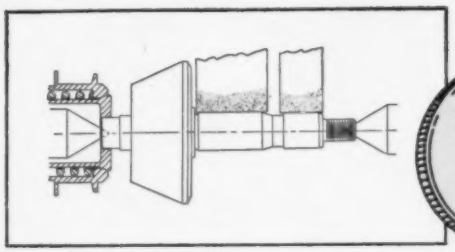
When a Type CTU Grinder is arranged for fully automatic loading and grinding of valve pistons the part is held on centers and driven by a floating type collet. Work is ground by a double-wheel mount.



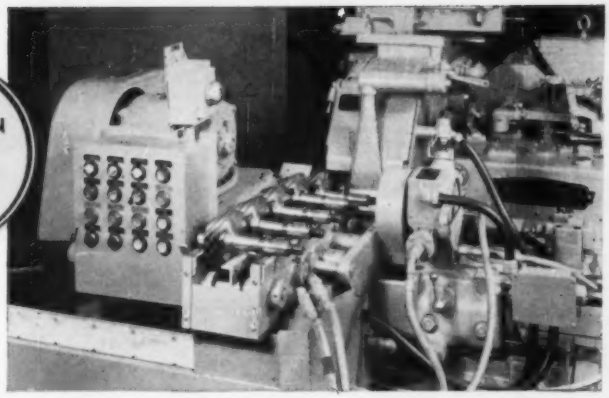
SAVINGS ON *Transmission Sleeves*



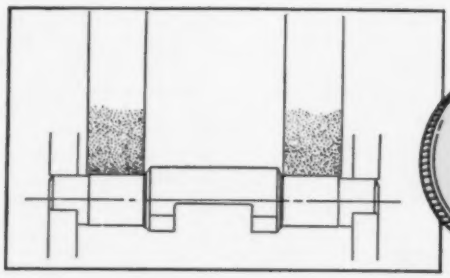
On this Type CV-4 Angular Wheelslide Grinder chucked grinding of transmission sleeves is arranged in a completely automatic cycle. Longitudinal movement of a revolving turret loads the machine. A stripper type plate removes the piece when turret retracts as the grind is terminated by electrically timed control.



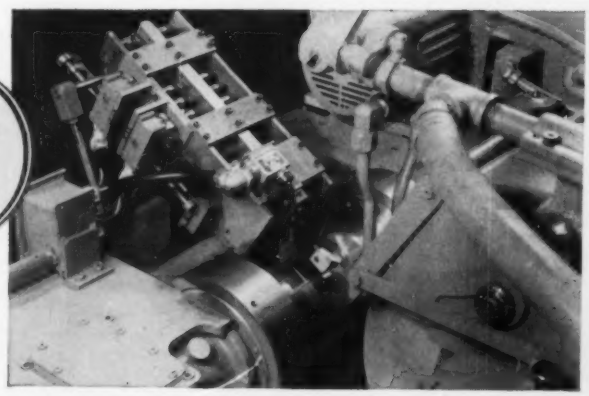
SAVINGS ON *Stem Pinions*



The Stem Pinion Grinder reduces time and effort with a completely automatic cycle, electrically timed arrangement for grinding these hard-to-handle parts. Progressive escapements in the automatic loading mechanism release the parts in succession, avoiding gear mesh.



SAVINGS ON *Pinion Shaft*



Here's automatic handling and grinding in the Type CTU CRANK-O-MATIC Crankpin Grinding Machine of parts that require clamping on both ends. Result — faster production with reduced operator attention.

To aid you in cutting your production costs to lowest possible, Norton has developed a wide range of fast, automatic grinders in conventional and angular wheelslide types — also special grinders, including types for grinding automotive valve faces and crankshaft pins.

Catalog No. 1859-1 gives information on how work is loaded and unloaded automatically on cylindrical and angular machines. You get the complete story — including specific recommendations for lowest cost grinding of cylindrical parts — when you give your Norton Representative full work details and production requirements.

He is part of the Norton team, the only team offering such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower costs. Contact him soon, or write to NORTON COMPANY, Machine Division, Worcester 6, Mass.

District Offices:
Worcester • Hartford • Cleveland • Chicago • Detroit

To Economize, Modernize with NEW

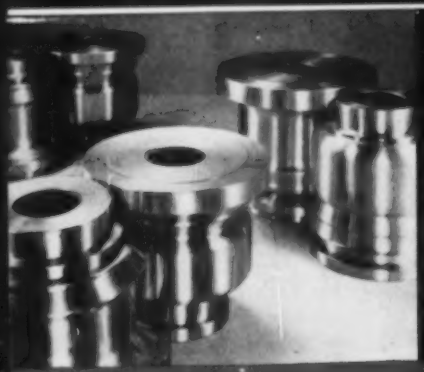
NORTON

GRINDERS and LAPPERS

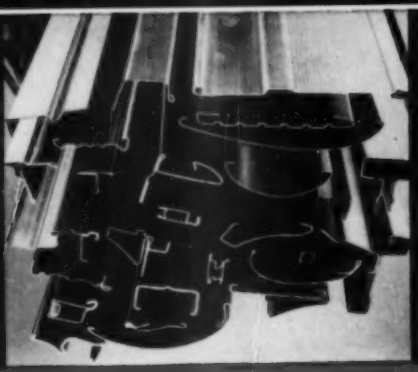
Making better products...
to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines
Refractories • Electrochemicals

BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



▶ Turning 3 to 20-stage rolls that . . .



▶ form automotive trim-molding is . . .

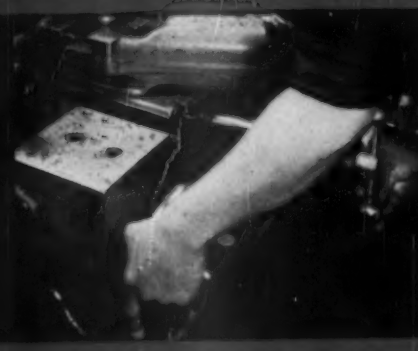
▶ a one-of-a-kind job of craftsmanship . . .

▶ checked . . .

▶ rescraped . . .

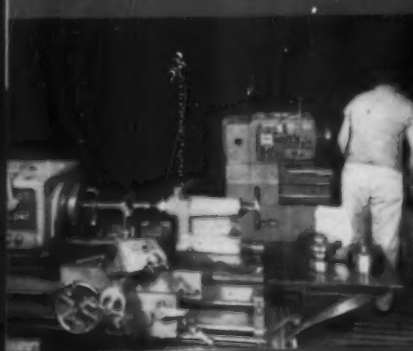
▶ and checked again . . .

▶ Lathe craftsmen like these need . . .

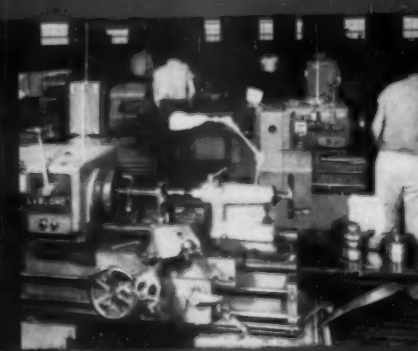


▶ smooth, responsive controls . . .

▶ simple, convenient speeds . . .

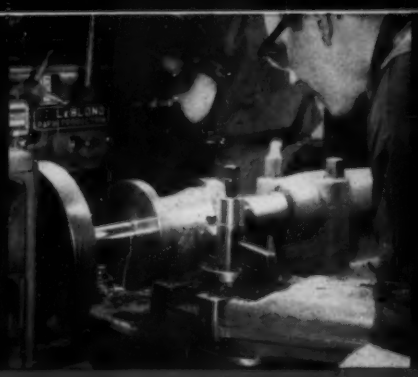


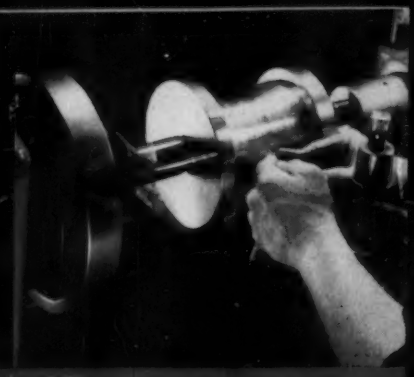
▶ bought 2 new LeBlond Rapid Productions . . .



▶ To work alongside their 3 LeBlond Dual Drives . . .

▶ while one other-make lathe sits idle!

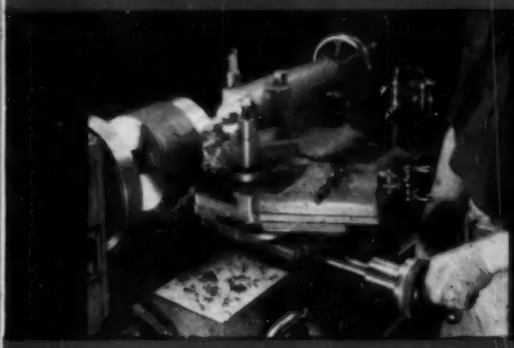


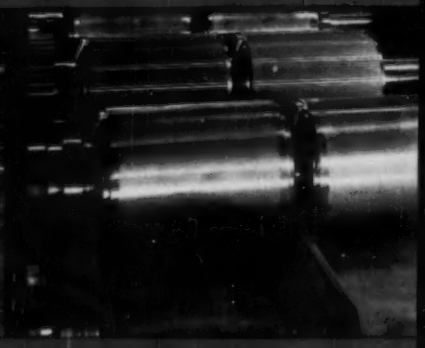


▶ First, females are roughed, then . . .

▶ turned to near-dimension . . .

▶ scraped with hand-held tool . . .

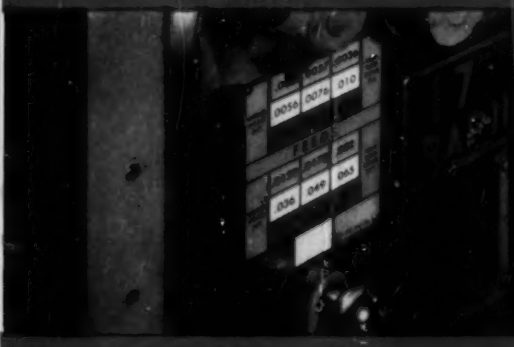


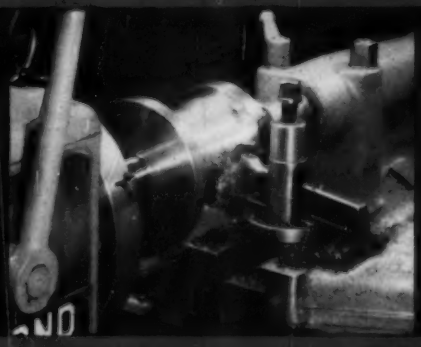


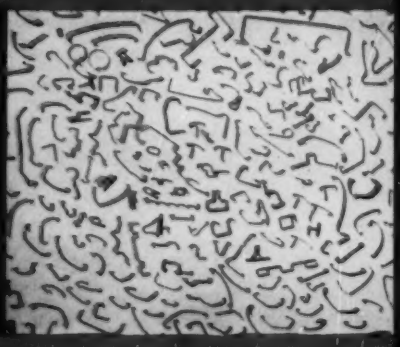
▶ Next, mating male is turned and scraped . . .

▶ checked with female using feeler gage . . .

▶ and final-checked in rolling mill . . .







▶ and feeds . . .

▶ power, and rigidity that lasts.

▶ That's why Dexter Roll Form Co., Detroit . . .

The R. K. LeBlond Machine Tool Company

World's Largest Builder of a Complete Line of Lathes for More Than 71 Years

Cut with Confidence . . .

LEBLOND of Cincinnati

Cincinnati 8, Ohio

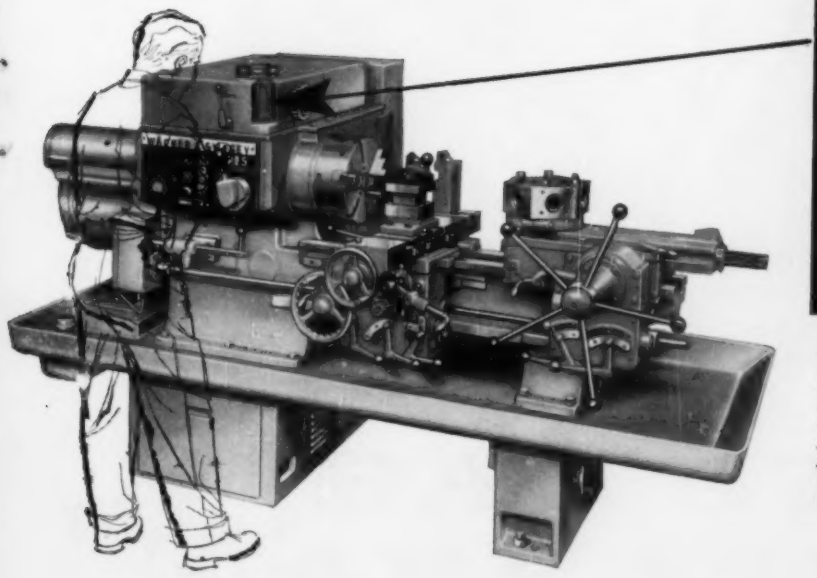
▶ Remember, with turning craftsmen, it's LeBlond. Ask them.

ARNER & SWASEY
1A

Warner & Swasey's exclusive Preselector provides easier and faster speed changing

- ***CALIBRATED: WORK DIAMETER—RPM-SFM***
- ***SELECT IN ADVANCE—CHANGE AT A TOUCH***

Ease-of-operation is built into all Warner & Swasey equipment because our design engineers know maximum production can be obtained only when operators like their machines. As an example: Our patented Preselector permits easy set-up of the next cutting speed while a cut is still being taken, saving valuable production time within the work cycle. Operators like the Preselector's rapid touch-control of our hydraulic headstock. Because it's quicker and easier to change speeds in Warner & Swasey's effectively-designed headstocks, machining is far more efficient, requires less tiring effort. Speed Preselectors are available on all Warner & Swasey Saddle Type Turret Lathes as well as on No. 4 and No. 5 Ram Type Machines. Yes, your operators can handle work faster, better and more economically on Warner & Swaseys. Our local Field Representative has all the facts. Why not call him, today?



Surface speeds for various work diameters at each RPM setting are shown on a large direct-reading chart. Correct speeds are chosen for each cut without requiring separate surface speed calculations, then marked in sequence with numbered clips placed along the top of the chart drum. By following his clips, operator preselects the correct speed for each cut with a glance-and-a-twist of the knob—and when he's ready, gets that speed with just a touch on the handle.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

How Earl Singleton cut the cost of

With 28 years experience in the abrasives industry, Bay State distributor Earl Singleton figures that one improvement in a grinding operation ought to lead the way to another. And, judging by the results he's produced, he's 100% right.

This is a good example of what happens when you tell a Bay State distributor your problem and give him a chance to experiment.

The problem: Grinding teeth on heavy traction gears for diesel locomotives at the Indianapol's plant of a large manufacturer of components for diesel locomotives.

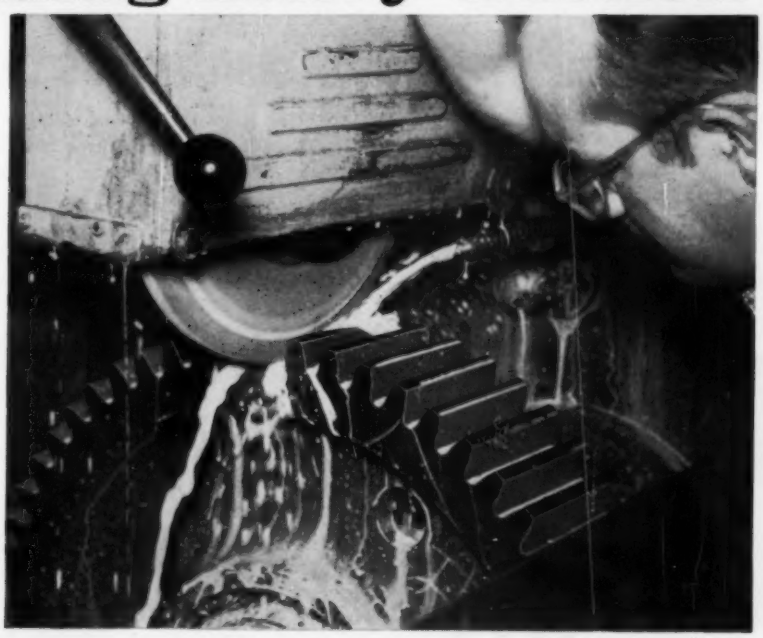
The man: Earl Singleton, Abrasive Engineer at Browning Tool & Supply Co., Indianapolis.

Working with the foreman of the department, Singleton came up with a 14" grinding wheel that cost 14% less than the premium-priced wheel it replaced. It held form better, too, and so didn't need to be dressed as often.

That was fine. But Singleton figured they might also get more pieces per wheel if they used a slightly larger wheel. After exhaustive tests to ensure complete safety, a 15" wheel was put to work and wheel life was more than doubled . . . from 16-17 pieces to 35-36. Down-time was reduced, too.

Even if you seem to have no particular grinding problems at the moment, it's worth while getting acquainted with the Bay State distributor in your area. Like Earl Singleton, he may find ways to save you money that haven't occurred to the people in your shop. *Better grinding at lower cost – that is his business.*

grinding heavy traction gears



Bay State specification cut wheel cost 14% . . . *and* wheel held form so well that wheel life was doubled under regular production conditions.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

PRECISION

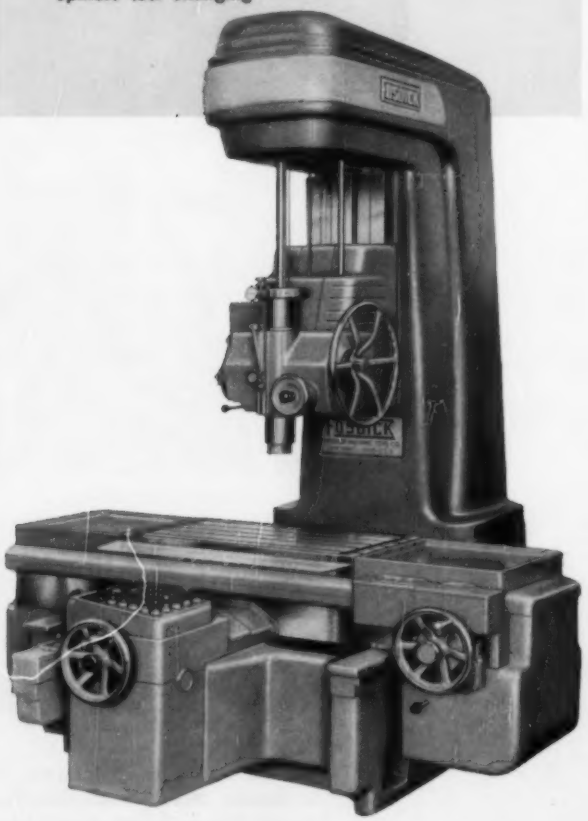
LONG TABLE TRAVEL

Longitudinal travel—48" Cross travel—22"

AUTOMATIC POSITIONING

with Direct Dimension Measuring and fast B-F Spindle tool changing

FOSMATIC JIG BORER



BORING

WITH NO REJECTS

hole location accurate to ±.0001"

hole sizes repeated to ±.0001"

SAVE 300 HOURS PER UNIT

on precision boring of gear boxes. Each unit (2 halves) calls for over 200 holes from ¾" to 4½" dia. Boring, spot facing, recessing, milling, tapping and counter boring. Material is aluminum alloy.

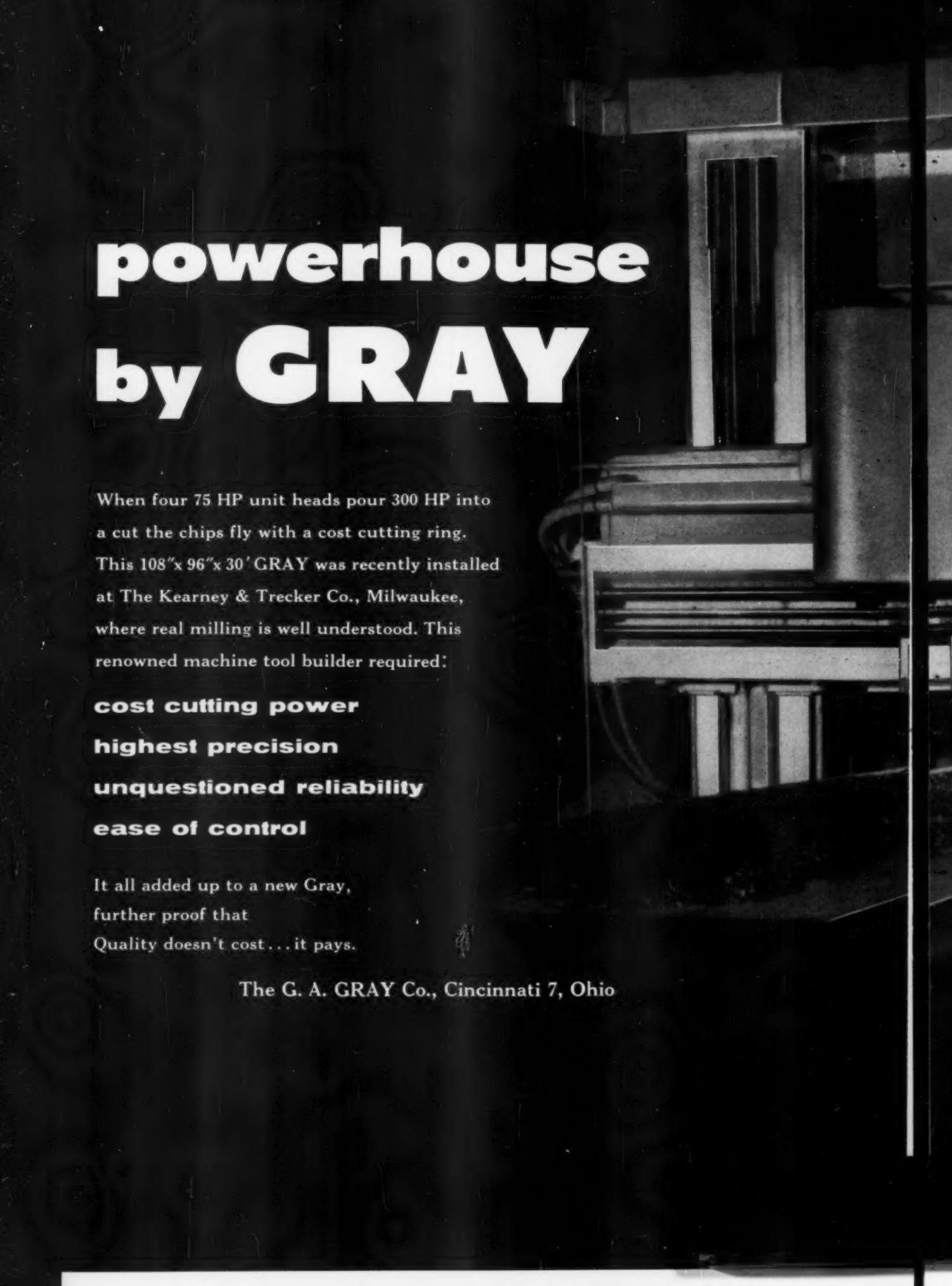
Boring time reduced from 800 hours to 500 hours per unit—with no rejects in all 50 parts—and every one.accurate to ±.0001" on hole size and location! Over 200 holes per unit are machined.

Mr. R. Schmidt of Triangle Tool Co., Union, N. J., owner of this Fosmatic Jig Borer, reports, "Two Fosmatic features were largely responsible for this important time saving. First, the Fosmatic's long table travel permitted machining two parts at once. Second, the automatic positioning and Direct Dimension Measuring System work simply and fast. They eliminate confusion and help the operator work accurately and efficiently. Incidentally, that long table travel helped get us several new jobs we could never have handled on our other jig borer."

With Direct Dimension Measuring the operator sets dimensions direct from blueprint onto two direct reading drum dials. At the press of a button, the table automatically positions work to ±.0001". On the Fosmatic, this operation and all other machine functions can be numerically controlled by punched tapes or cards.

Fosmatic Jig Borers bring you many important advances in boring technology. Where progress has been so great, the obsolescence of your old machine may be more costly than you suspect. *Why not run a check?* Call your Fosdick Distributor or write us today.

Ask for Fosmatic Jig Borer Bulletin JB-A



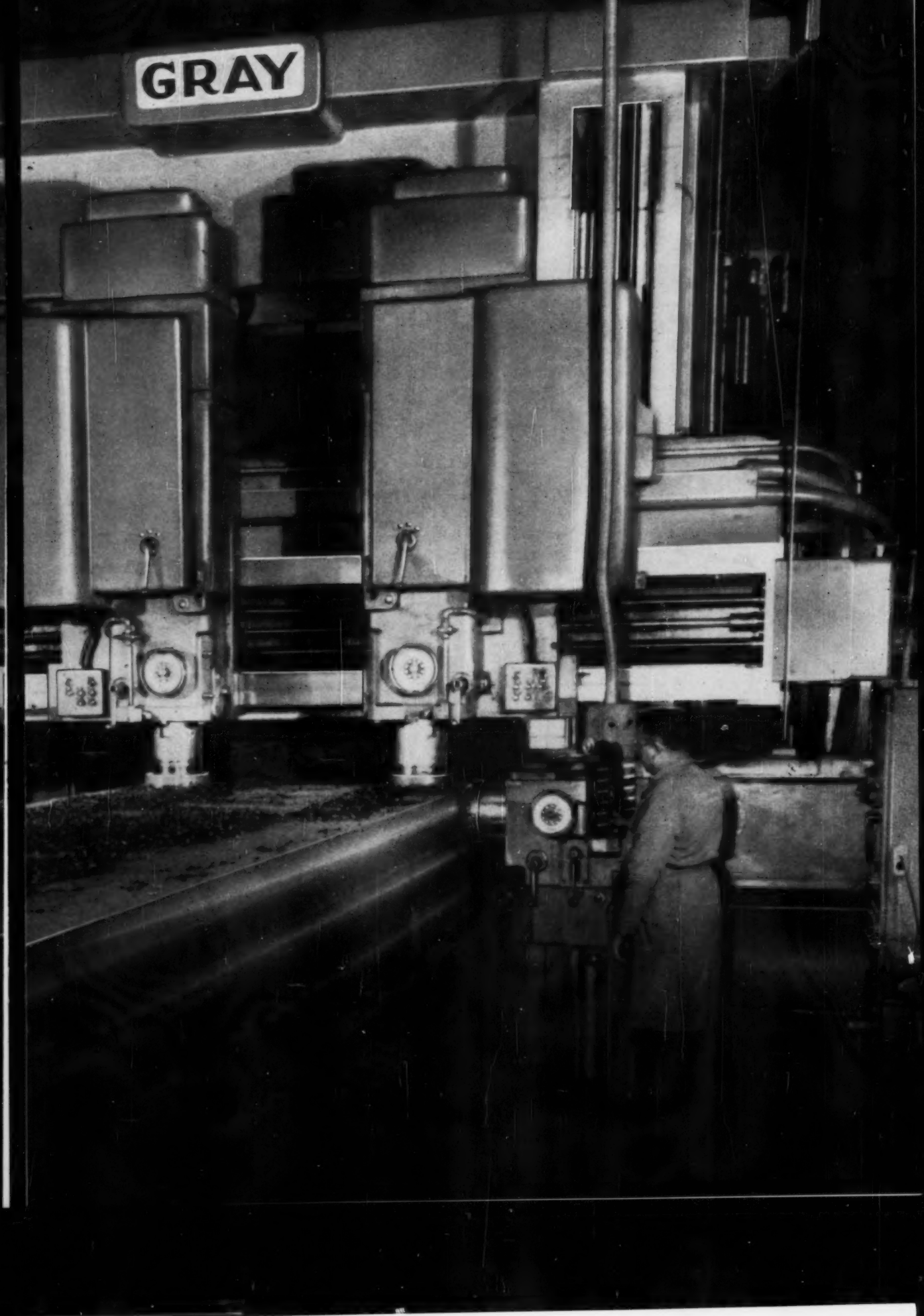
powerhouse by GRAY

When four 75 HP unit heads pour 300 HP into a cut the chips fly with a cost cutting ring. This 108″x 96″x 30′ GRAY was recently installed at The Kearney & Trecker Co., Milwaukee, where real milling is well understood. This renowned machine tool builder required:

cost cutting power
highest precision
unquestioned reliability
ease of control

It all added up to a new Gray,
further proof that
Quality doesn't cost . . . it pays.

The G. A. GRAY Co., Cincinnati 7, Ohio

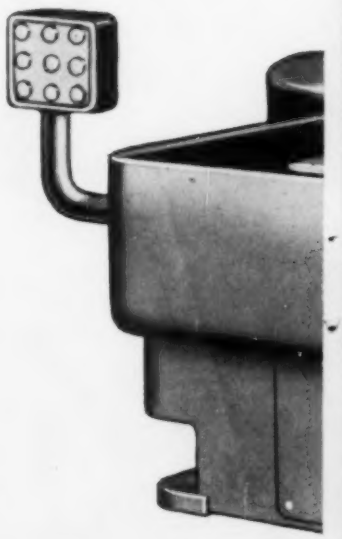

GRAY

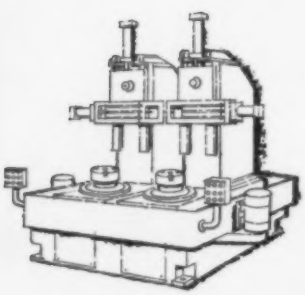
News in Machine Tools

New M&M Multi-Spindle Two Column Vertical Turners add flexibility to standard machining operations

Here's a machine tool designed for precision turning, boring and facing operations with versatility for long and short run production jobs. Features:

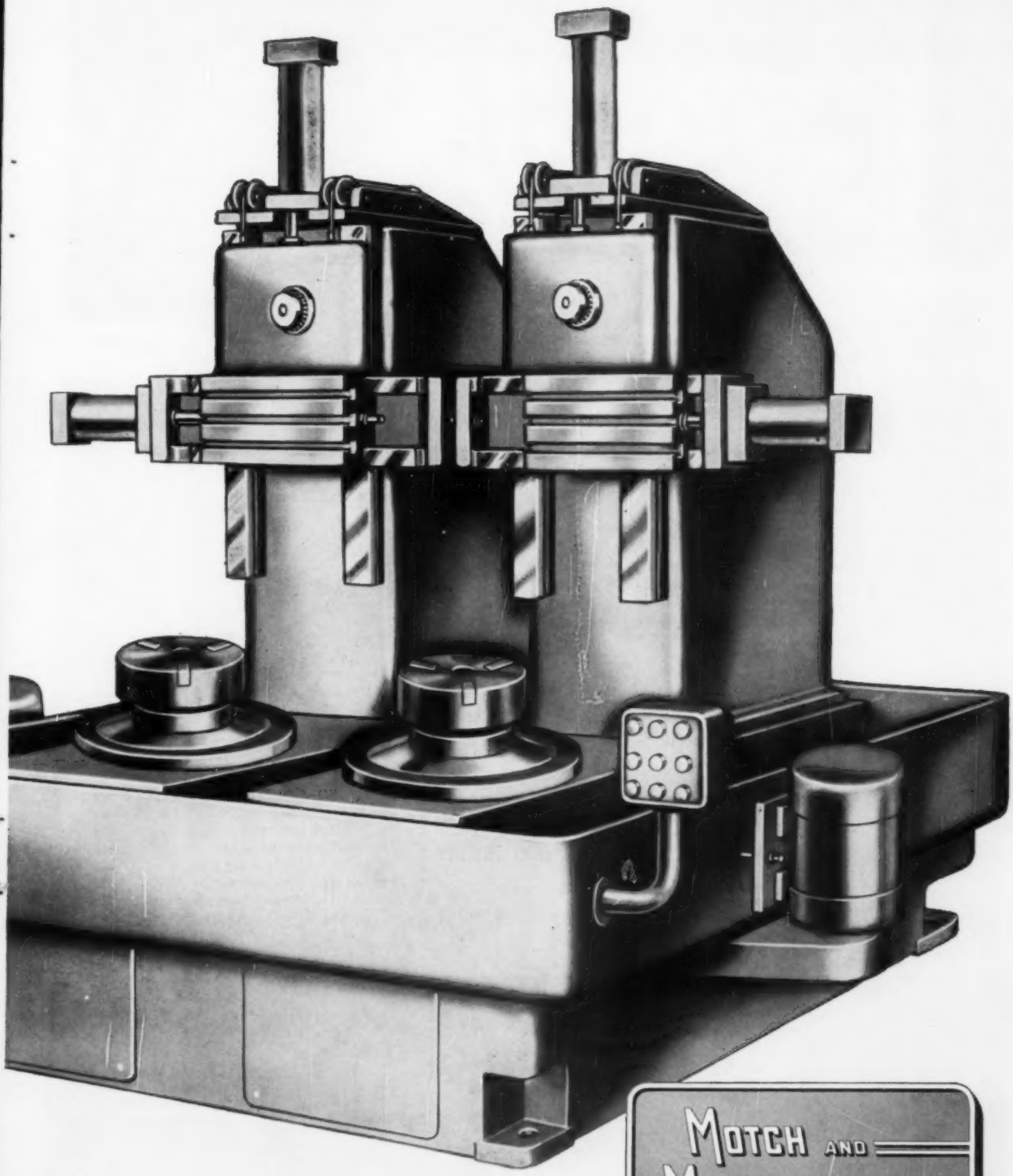
- spindles will accommodate *any* type chuck including air operated draw bar
- automatically-lubricated tool slides
- slide ways of hardened and ground steel with tapered gibs for accurate alignment and easy adjustment
- hardened adjustable slide stops
- hydraulic or cam-actuated slide-feed, rapid traverse and rapid return
- separate controls for each spindle and slide unit to permit their independent operation on two-spindle machine
- on four-spindle, two column machine, spindles are controlled in pairs, separate controls for each pair
- "building block" design for easily-made tooling and slide changes to accommodate a wide variety of work
- design features accessibility for simple, speedy maintenance of spindles, motors, hydraulic cylinders and/or cams and slides for minimum downtime





We can show you, in detail, how this new adaptable metal-working machine will improve your present machining operations. Call your nearby Motch & Merryweather representative, or write: Motch & Merryweather Machinery Company, 1250 E. 222nd St., Cleveland 17, Ohio.

BUILDERS OF AUTOMATIC PRECISION CUT-OFF.

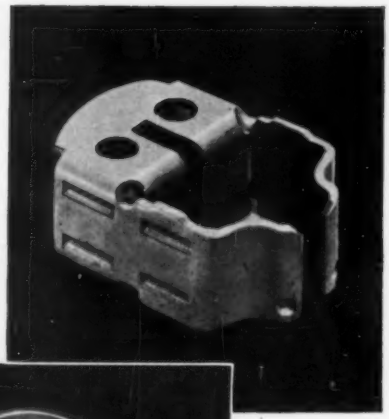


MOTCH AND MERRYWEATHER

Machine Tool Manufacturing Division
Cutting Tool Manufacturing Division
• CLEVELAND •
Avey Division, Cincinnati

ON JOBS LIKE THIS CORBIN TURNS TO

U.S. MULTI-SLIDES®



The Corbin ball bearing latch bolt retractor is just one of a multitude of stampings which can be produced — complete, without secondary operations, handlings or inspections — on U. S. Multi-Slide Machines. In the U. S. Multi-Slide, a combination of motions built into the machine itself greatly simplifies the designing of tools to fabricate precision formed metal stampings. Because these motions are part of the standard machine equipment, it is not necessary to incorporate complicated movements into the dies. Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position; and vertical movement for stripping and transferring. U. S. Multi-Slide Machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously. These features make the U. S. Multi-Slide extremely versatile in the automatic, high-speed production of all types of formed metal stampings.

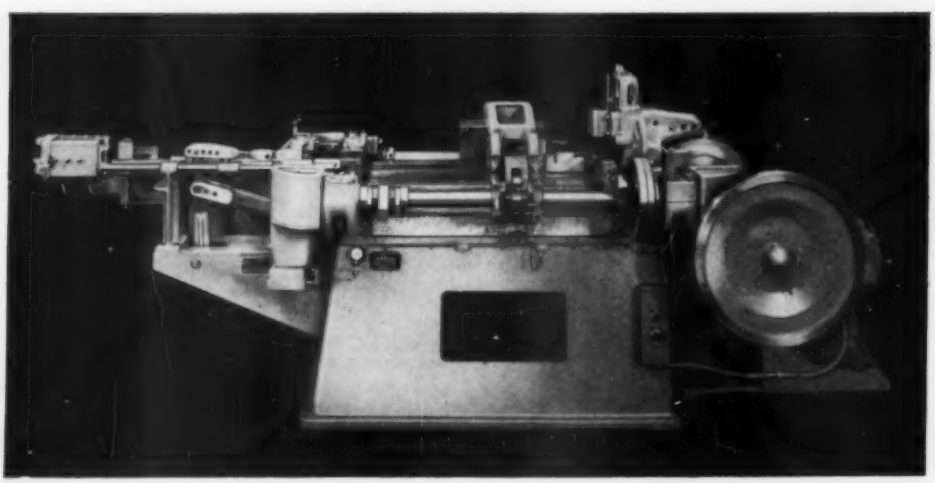
The Corbin Latch Bolt Retractor shown above illustrates the unique ability of the U. S. Multi-Slide to produce thousands of uniformly precise parts — faster and better. Completely formed to close tolerances from strip metal, this part is non-jamming, self-aligning and practically indestructible. Thus, it imparts to Corbin Locksets the famous "velvet glide" knob action, long life and trouble free service — qualities which were found previously only in higher priced custom units, but which are now, thanks to U. S. Multi-Slides, an integral part of every Corbin Standard Duty Residential Lockset.

If you want to produce parts uniformly . . . at high speeds . . . and to close tolerances, write for a copy of Bulletin 15-A, or send part drawings or samples for our recommendations.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) **NEW JERSEY**

Builders of U. S. Multi-Slides — U. S. Multi-Millers
U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories



Left: The U. S. No. 35 Multi-Slide Machine used, with appropriate tooling, to produce the Corbin Latch Bolt Retractor shown above.

HARDINGE
ELMIRA, N.Y.

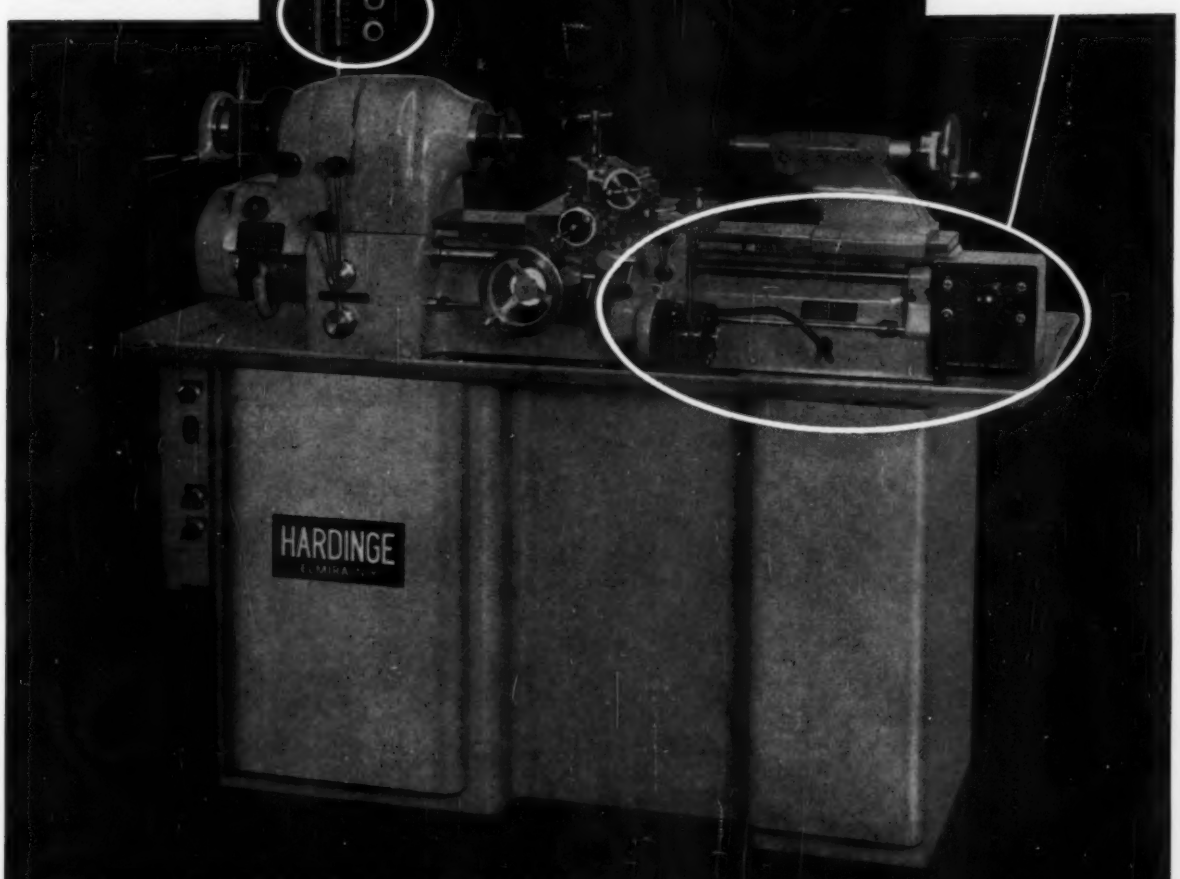
Tool Room and Production Lathe

Features

Infinite Control of Speed and Feed

Variable Speed Drive for Headstock Spindle

Variable Feed Drive for Carriage and Cross Slide



RIGIDLY BUILT TO TAKE ADVANTAGE OF CARBIDE CUTTING TOOLS AT HIGH SPEEDS.

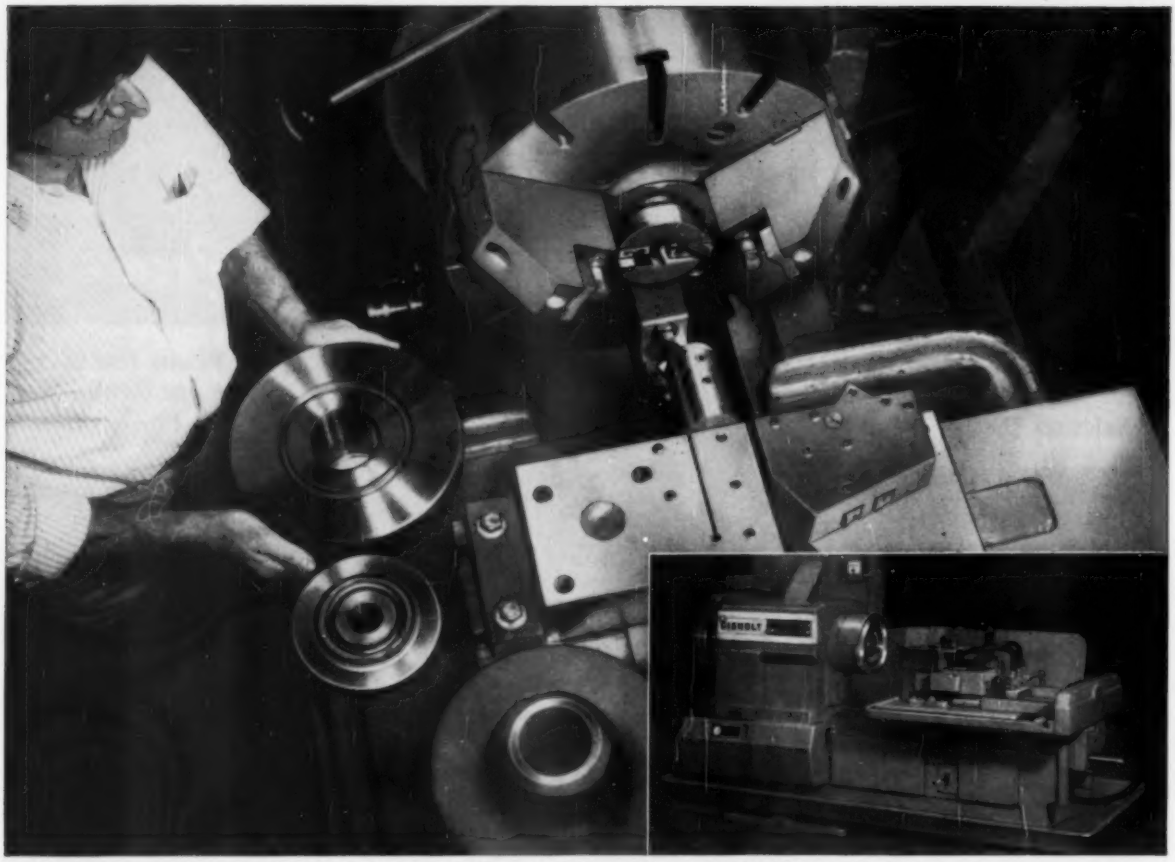
Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds.

Write HARDINGE *for Bulletin HLV*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N. Y.



Smart planning on Simplimatic holds f.t.f. time to 1.7 min. on 6½" diam., 3.3 min. on 10¾" diam. workpieces.

How OTM Corp. cuts costs machining parts in 13 sizes

Handles each part in single chucking, using Simplimatic with back-facing attachments and two-speed motor

You may get ideas from the way OTM Corporation, Houston, Texas, machines steel welding neck flanges and welding necks—with each part in 13 different sizes—completing each part in a single chucking and holding change-over time to an absolute minimum.

Here's how the job is done on a Gisholt Simplimatic Automatic Lathe: Facing, grooving, boring and chamfering operations are performed from tools on short tool slides, with T-slotted tops for quick adjustment. Relieving the boring tool at the end of the cut eliminates tool tracks. Simultaneously, a special back-facing attachment works through the spindle to shave-face and chamfer the O.D. on the hub. A power chuck wrench operates the scroll chuck and permits mounting this attachment in the spindle bore. A two-speed motor provides correct surface speed and permits switching from high speed (for turning and facing) to low speed (for grooving operation) and back again, during the Simplimatic's automatic machining cycle.

Here, again, the Gisholt MASTERLINE Simplimatic Automatic Lathe saves a manufacturer the cost of a special machine. Its extra wide platen table provides ample space for an infinite number of slide and tool arrangements—and its table feed permits tools to engage with the work or perform additional machining operations before actual slide movements begin. Ask your Gisholt Representative to show you how the Simplimatic performs special machine functions at standard machine prices—on your product and under your production conditions.

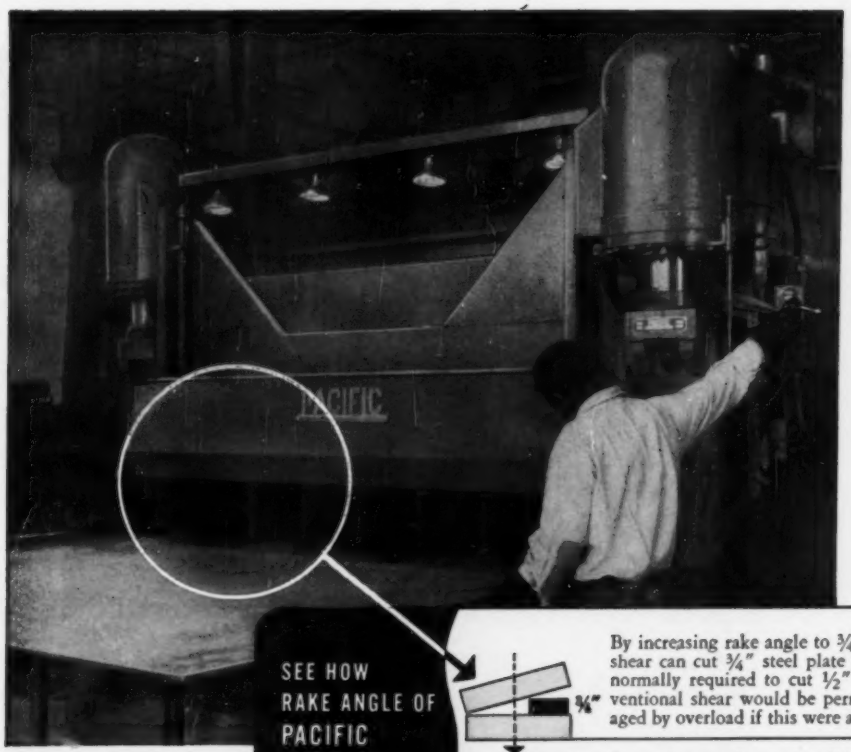
MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for new Catalog 1159-C on Gisholt MASTERLINE Simplimatic Automatic Lathe. Shows 39 typical jobs—fully illustrated.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY REBUILT MACHINES WITH NEW MACHINE GUARANTEE



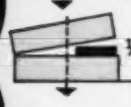
Adjusting Pacific rake angle by hand control lever

NOW...

a ½" shear adjustable to cut full length ¾" plate continuously*

SEE HOW RAKE ANGLE OF PACIFIC HYDRAULIC SHEAR IS CHANGED FOR PERFECT SHEARING OF ANY THICKNESS OF METAL

By increasing rake angle to ¾" per foot the shear can cut ¾" steel plate with the force normally required to cut ½" plate. A conventional shear would be permanently damaged by overload if this were attempted.



In cutting rated capacity (½"), **shear cuts** exactly the same as conventional fixed rake angle shear.

In cutting 3/16" steel, the rake angle is reduced to 3/32" per foot and the shear will cut strips 24" long up to 60 per minute with less twist and bow than with any conventional shear.

ABOVE, RIGHT: *¼" plate cut with Pacific adjustable rake shear*

ABOVE, LEFT: *¼" plate cut with conventional shear*

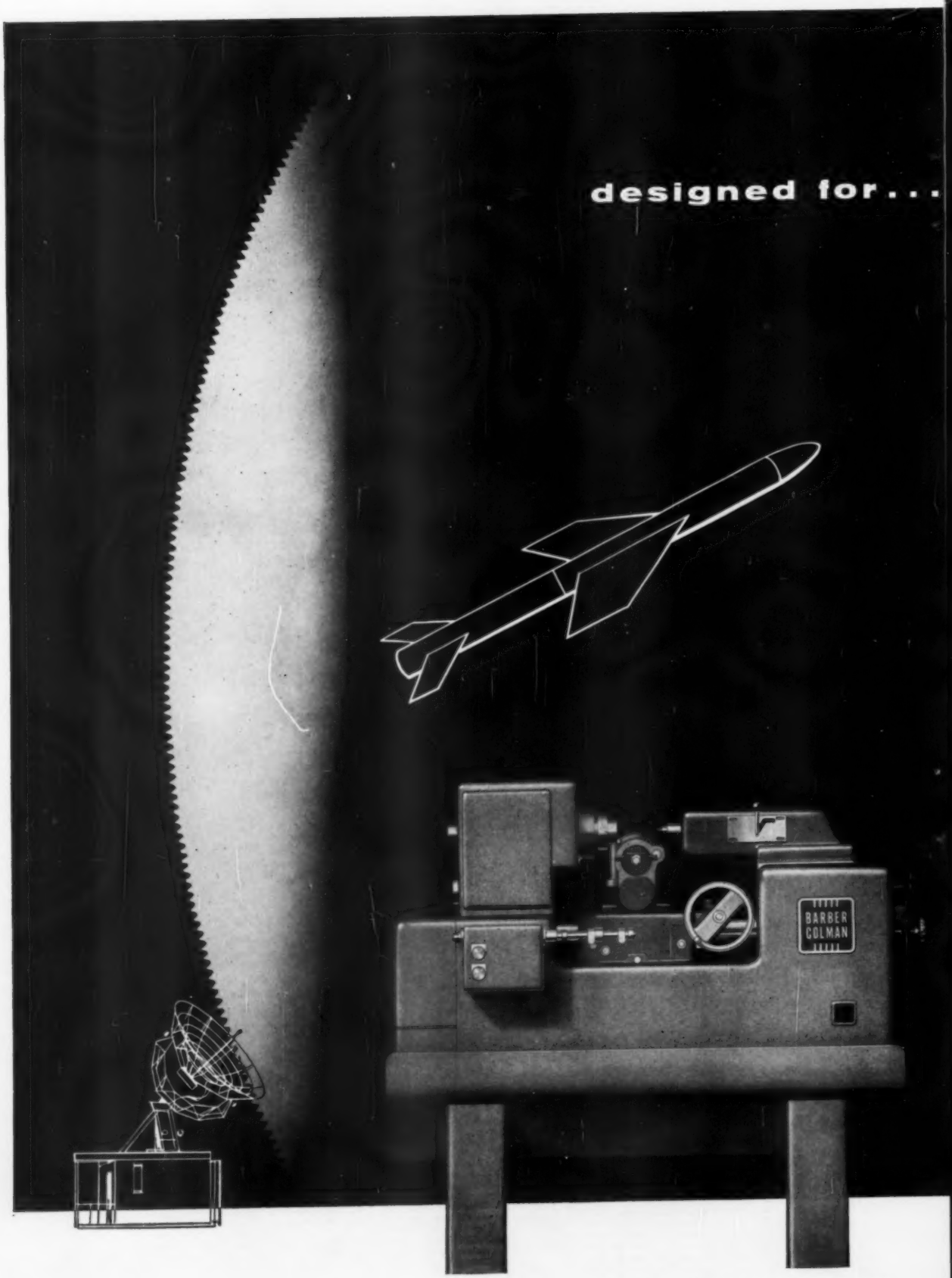
Rugged Pacific Hydraulic Shear cuts steel from 20 gauge to ¾" plate with optimum knife clearance. The knife clearance can be adjusted in 30 seconds to match plate thickness. Pacific Hydraulic Shear cuts noiselessly without shock. Knives last 2 to 3 times longer . . . maintenance downtime from blade changing is greatly reduced. Pacific Hydraulic is the safest shear. The ram, controlled by a portable foot pedal, can be stopped instantly at any point throughout the stroke in an emergency. Pacific Hydraulic cannot be damaged by overload. Independent time studies confirm that it will equal or out-produce any mechanical shear.

*with optimum knife clearance.

PACIFIC HYDRAULIC SHEAR

Mfg. by
PACIFIC INDUSTRIAL MFG. CO.
848 49th Ave., Oakland, Calif.
Plants: Oakland, Calif. and Mt. Carmel, Ill.

DISTRIBUTORS:
LOS ANGELES—Tornquist Machinery Co. • PORTLAND—Portland Machinery Co. • SEATTLE—Buckner Weatherby Co. • SALT LAKE CITY—Todd Machinery Co. • DENVER—R. E. Dubec Associates • HOUSTON—Butcher, Carter & Preston Co. • DALLAS—Machine Tool Associates • TULSA—Martin Machinery Co. • KANSAS CITY, DES MOINES & ST. LOUIS—Machinery Engr. Co. • NEW ORLEANS—Dixie Mill Supply Co. • NORFOLK—Tidewater Supply Co. • PITTSBURGH—Steel City Tool & Machinery Co. • CLEVELAND—Wigglesworth Machinery Distributors • INDIANA—Harry B. Green Machinery Co. • CHICAGO—The Gute Co. • MILWAUKEE—The Gute Co. • DETROIT—Taylor-Thompson Machinery Co. • MINNEAPOLIS—The Gute Co. • LOUISVILLE—Harry B. Green Machinery Co. • ALBUQUERQUE—R. E. Dubec Associates • WYNNEWOOD, PA.—Edward A. Lynch Machinery Co. • MT. VERNON, N. Y.—William Halpern & Co., Inc. • WETHERSFIELD, CONN.—Beisel Machinery Co. • TORONTO—Hercules Presses, Ltd.


designed for...
BARBER
COLMAN

. . . precision instrument gears

new Barber-Colman hobber guaranteed to index accurately within 20 seconds of arc

Barber-Colman engineers have developed a new hobbing machine which guarantees indexing accuracy suited to gears used for aircraft, missile and radar guidance systems. This machine is known as the No. 2½ - 4 hobbing machine and hobs precision spur gears up to 2½" diameter x 2¼" face width, 30 D.P. in steel and 20 D.P. in brass. It provides accuracy, capacity and rigidity for precision fine-pitch work within a nominal price range.

One of the most important features of the new No. 2½ - 4 hobbing machine is the accuracy of relative rotation between the work spindle and the hob spindle which is guaranteed within 20 seconds of arc. This means that the spacing error on the gear caused by the indexing error of the machine would not exceed .00014" on a 2½" diameter gear.

The machine has a capacity for using 3" diameter hobs providing for a greater number of flutes to produce smooth gear tooth profiles. Using proper care in rigid tooling, accurate blanks, mounting of hob and work, and Class AA hobs with accurate sharpening, precision gears to Class 3 tolerances are hobbed with this machine.

Several design features are a departure from standard hobbing machine construction. There is no hob slide — only a hob carriage for conventional feed. In place of a hob slide, the hob arbor is mounted on a swivel which adjusts to compensate for hob thread angle. The work slide is stationary, and the hob swivel raises and lowers to meet diameter requirements. The machine has no overarm support, permitting greater work visibility and operator access. Both work and hob spindles are mounted in precision anti-friction bearings to provide accurate rotation at high speeds. The hob carriage also has anti-friction way supports, and the metal-to-metal contact afforded provides more rigidity than obtained with gib-type mounting. An infinite number of hob speeds are provided without change gears in the range of 200 to 1200 r.p.m.

Rigidly constructed, with a steel weldment base and heavy grey iron machine bed, the machine is designed with a minimum number of parts at points where deflection and inaccuracies may occur. Net machine weight without tooling is approximately 1500 lbs. Standard equipment includes motor and controls and one set of change gears.

For complete specifications and data contact your nearest Barber-Colman representative, or write directly to the factory for a copy of new bulletin F-8642.

BARBER-COLMAN COMPANY

717 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it

Turret Lathe Tracing Pays off Double — and More!

It is hard to select the "best" feature of a J & L turret lathe which is equipped with a tracing unit. It could be the cost saving factor, as in the job illustrated above. Stainless steel forgings are first rough-machined with tools from the hexagon and square turret positions. Then, *in the same chucking*, the tracer is engaged and the parts are contoured to a 16 mu-in. finish at better than 1000 SFM. Manufacturing costs were cut 74%.

Another customer points out broader advantages. He says: "My turret lathe with its tracing attachment is the most versatile machine in my shop. It's a bar machine, a chucker, an engine lathe, and a shaft and cross-center duplicator, combined. No machine could do more, or produce more profits for me."

Write for detailed information. Jones & Lamson Machine Company, 502 Clinton St., Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Precision Boring Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For You?

FEDERAL

has supplied precision gaging for:

- **THOR**
- **BOMARC**
- **FALCON**
- **SPARROW**
- **ATLAS**
- **CORPORAL**
- **NIKE**
- **MATADOR**
- **DART**
- **NAVAHO**
- **FIREBEE**

Yes

if you have a responsibility in controlling the dimensional conformance of missile components.

This is an up-to-the-minute technical brochure on gaging as used to control quality in critical missile parts now being manufactured. With photographs, diagrams, and informative data it shows how certain challenging problems have been successfully overcome by combining Federal's specialized gage experience with the know-how of the customer's Engineering Dept. (and with that of the machine tool manufacturers when new machines or tooling is involved).

Each gage is clearly illustrated and the dimensions or dimensional conditions being checked (parallelism, squareness, co-planerity, concentricity, center-distance, straightness, etc.) are described and diagrammed. In addition to strictly dimensional gages, the brochure includes also descriptions of gages for machine set-up and for critical assembly operations.

We will be pleased to send a copy of this brochure to you.

FEDERAL PRODUCTS CORPORATION
8127 Eddy Street • Providence 1, Rhode Island

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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

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Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with machined seats; have sliding pin handles and free-acting swivel caps on point. Bodies have smooth sandblast finish. (8 sizes to 12" opening)

Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools.

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5215 W. ARMSTRONG AVE. • CHICAGO 30, U.S.A.

HEAVY DUTY "C" CLAMPS

Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiplies thread friction against loosening. Extra large screws are heat treated and hardened at point.

(11 sizes to 12½" opening)

MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and swivel cap on point. Ground seat. (9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or "swivel" screw types. (Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS

Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter. (8 sizes Capacities to 12" opening)

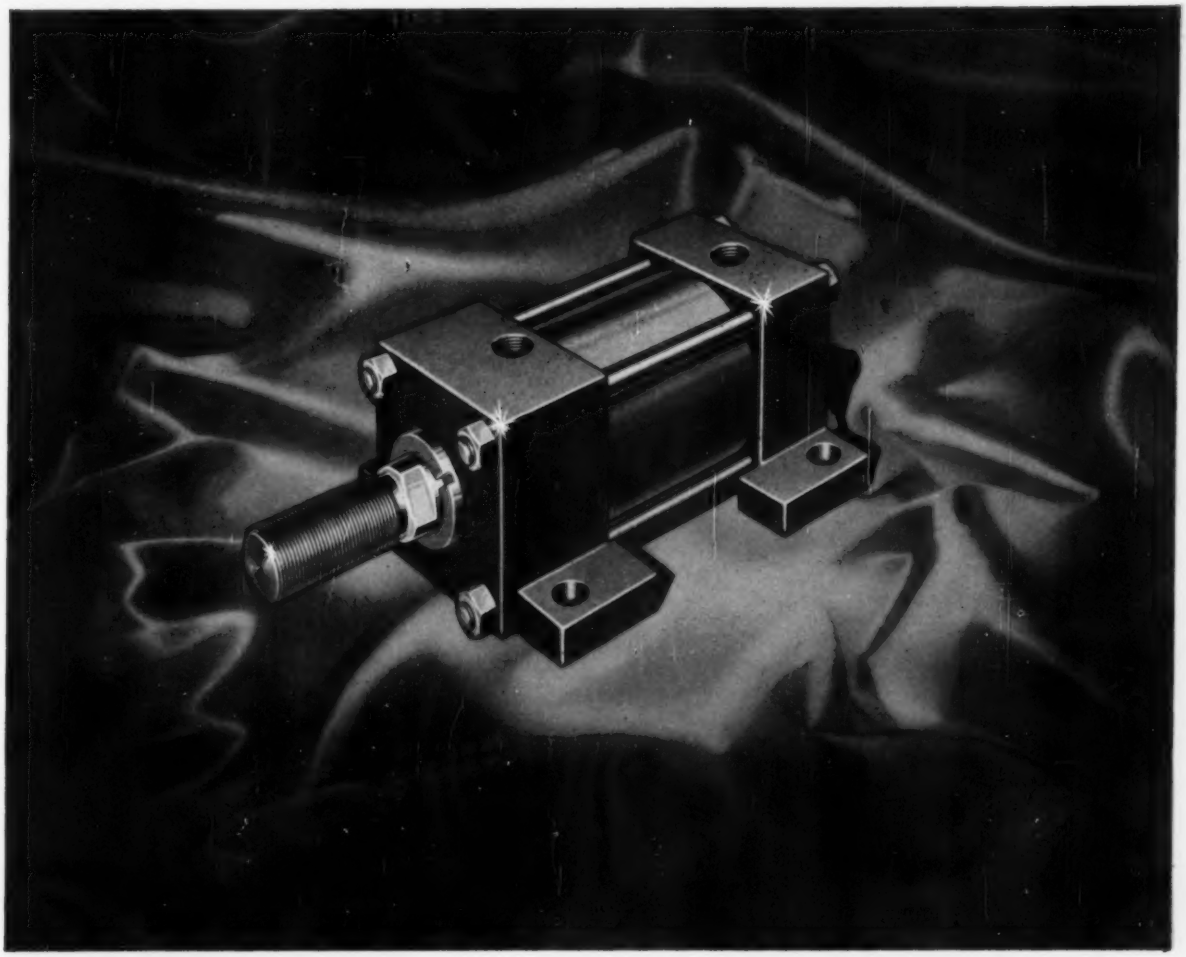
MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting. (Four sizes: Capacities to 4¼" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening. (3 sizes: Capacities to 2½" opening).

(Not Drop Forged)



Illustrated—Logan Super-Matic Cylinder Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic cylinder design

FREE SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
818 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-6 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 AND 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

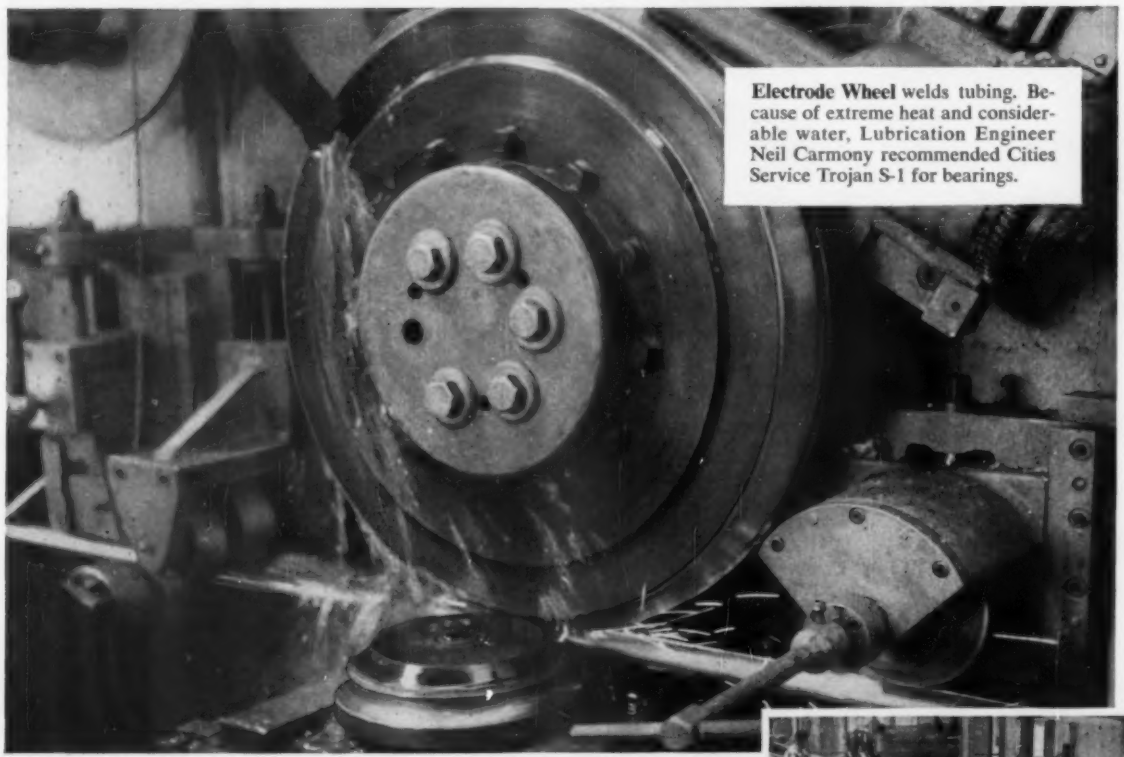
TO:

NAME _____ TITLE _____

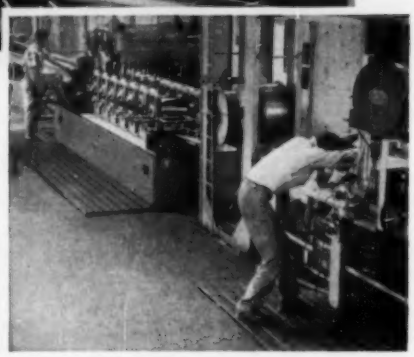
COMPANY _____

ADDRESS _____

New Tubing Mill Produces at Speed of 350 Feet Per Minute!



Electrode Wheel welds tubing. Because of extreme heat and considerable water, Lubrication Engineer Neil Carmony recommended Cities Service Trojan S-1 for bearings.



It's Cities Service for Hydraulic System and all lubrication

On January 1, 1957, P&H Tube Corporation put a new mill in production at Bossier City, Louisiana—the only one of its kind in the United States.

Equipped with special drives and worm gears, this unique mill actually produces at the rate of 350 feet per minute—twice the speed of conventional tubing mills!

With speeds like this, you might expect lubrication troubles . . . but P&H Tube Corporation has none. One big reason is the careful study of each machine made by Cities Service Lubrication Engineer Neil Carmony—and the lubrication recommendations he made.

In hydraulic units, for example, Carmony recommended Pacemaker 200-T Hydraulic Oil . . . for he knew its ability to withstand the severest operating temperatures and speeds. He knew that due to its exceptionally high viscosity index and superior compounding, Pacemaker 200-T would give maximum resistance to thinning, oxidation, rust and corrosion.

The wisdom of this decision, as well as the choice of other lubricants shown in the chart at right, was demonstrated recently when P&H Tube Corporation ran off 125,000 feet of tubing in an ordinary eight hour shift—with normal time-out for change-overs!

That's production with a capital P! And if you'd like to improve your production picture, a Cities Service Lubrication Engineer can help you, too. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

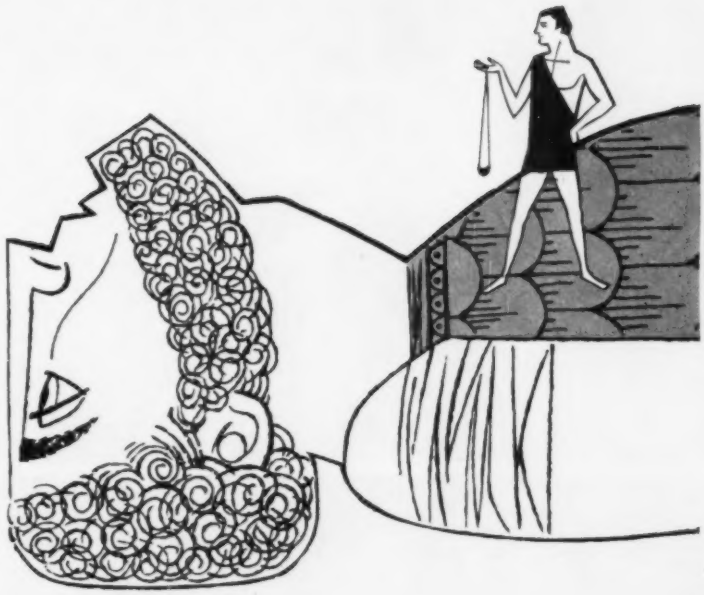
What the Cities Service Lubrication Engineer Recommended

Hydraulic units	Pacemaker 200-T
Bearings	Trojan H-2 Grease
Drive units	Pacemaker Oils
Bearings by the mill's electrodes	Trojan S-1

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

why use GOLIATH when "DAVE" can do the job at **1/2** the cost?

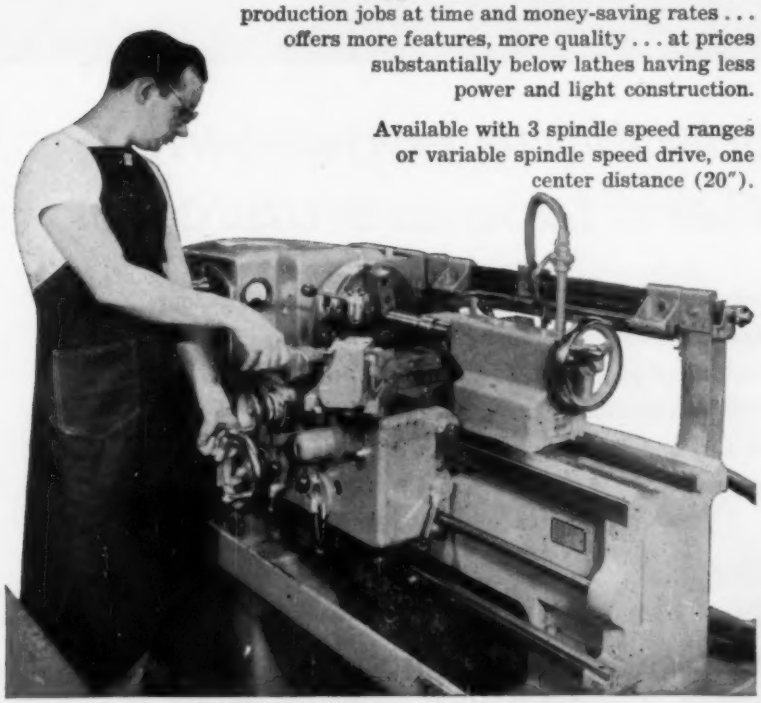


don't pay $20,000 when you can buy a LODGE & SHIPLEY Hi-Turn COPYMATIC TRACER LATHE for less than $10,000

A too-big, too-expensive tool doesn't mean you'll do the job quicker, better or at lower cost. There's new proof of that fact . . . in the 1307 (10") HI-TURN 45° COPYMATIC Tracer Lathe!

This rugged and versatile lathe is built to do production jobs at time and money-saving rates . . . offers more features, more quality . . . at prices substantially below lathes having less power and light construction.

Available with 3 spindle speed ranges or variable spindle speed drive, one center distance (20").



"EXCELLENT FOR HIGH PRODUCTION ON SMALL PARTS," says Indiana Gear Works, Indianapolis

This well-known precision gear manufacturer has a number of Lodge & Shipley lathes in a busy plant. The latest is a Hi-Turn COPYMATIC, evaluated as follows:

SPEED RANGE:
"The wide range of speeds available on this machine is definitely an advantage."

FEED RANGE:
"We are able to select the correct feed for all parts run on the machine."

DINABRAKE MOTOR:
"Speeds production."

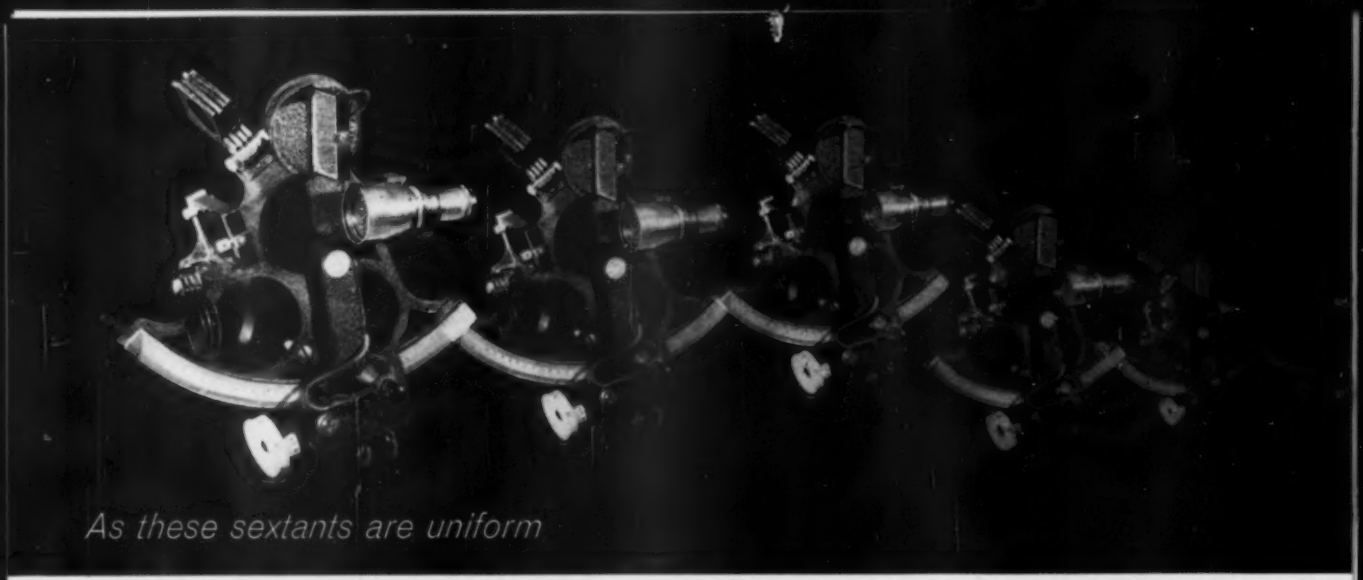
HP AMMETER:
"Enables the operator to run the machine at full capacity."

DESIGN:
"Compact, provides ease of set-up."

ACCURACY:
"Good."

For complete details, request Bulletin DM-4 from:

The Lodge & Shipley Co.
3056 Colerain Ave.
Cincinnati 25, Ohio



As these sextants are uniform

. . . So Card pipe taps are uniform, too

Your production's consistent ...because Card taps are uniform

Your first step in consistent production performance is the cutting tool itself. Because Card pipe taps are identical they keep production up to par — and predictable. Shopmen know about the uniformity of Card taps. Card gages are like that, too. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

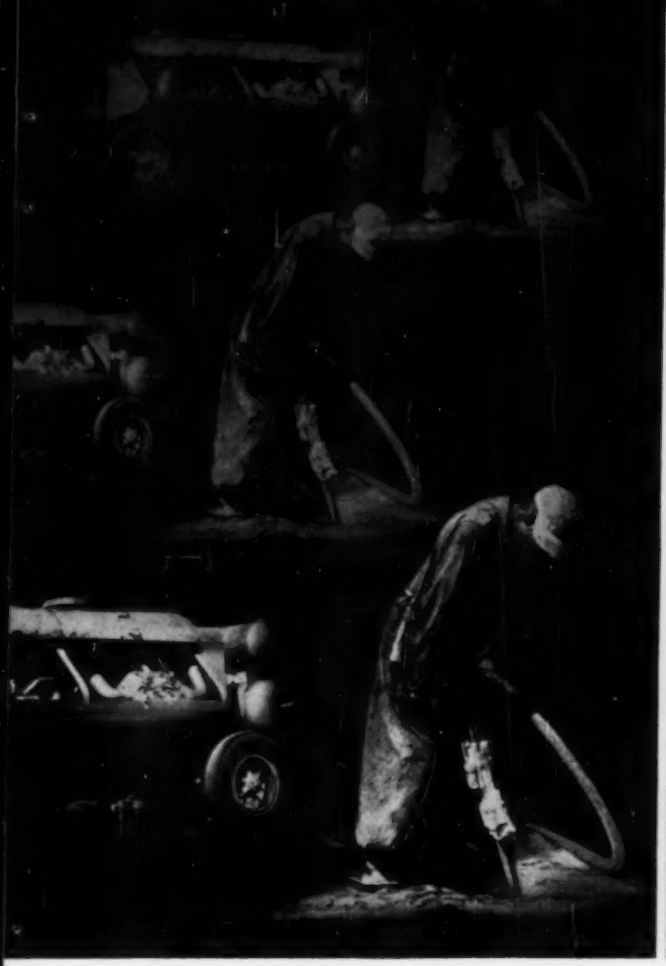
CARD Quality

CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through the best distributors from Coast to Coast

If you use cutters as much as air tools use compressed air...



This brand cuts down your cutter usage, production time and costs!

The more you use cutters the more you need Union

Union cutters — best in design, materials and workmanship — provide consistent top performance and lowest cost per piece produced. Union makes solid milling and gear cutters, as well as inserted blade cutters — also drills, end mills, reamers, hobs and carbide tools. **Available nationally through Union Distributors** and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

UTD

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

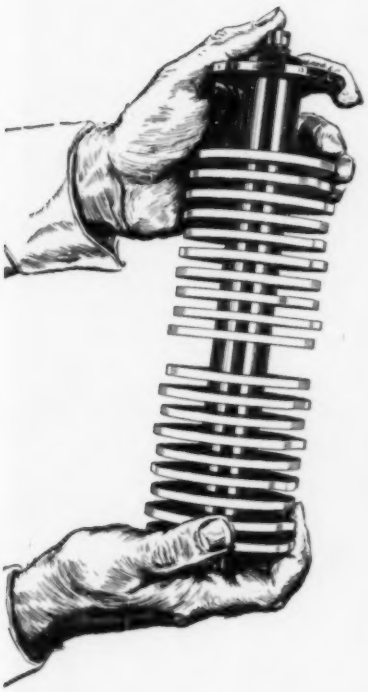
B-1120

Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

MARVEL Metal Cutting SAWS
Better Machines Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.

He's holding an automatic cycle



Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle lathe available today.

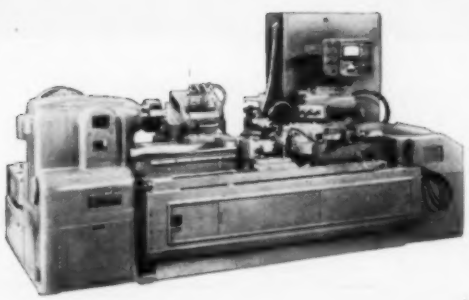
You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to fully realize the economies inherent in ceramic tooling.

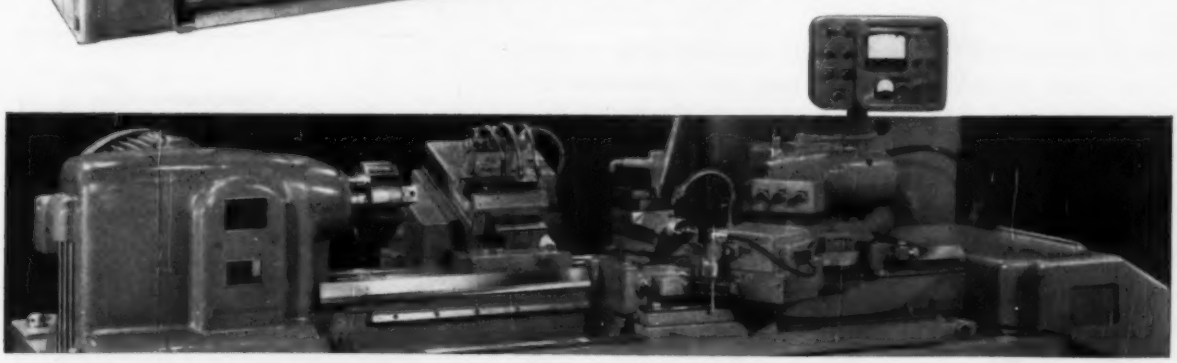
This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing multi-cycle programmer and making a few quick readjustments.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known. It's so fast in operation that the only limitation in cycle speed is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail... **The Monarch Machine Tool Co., Sidney, Ohio.**



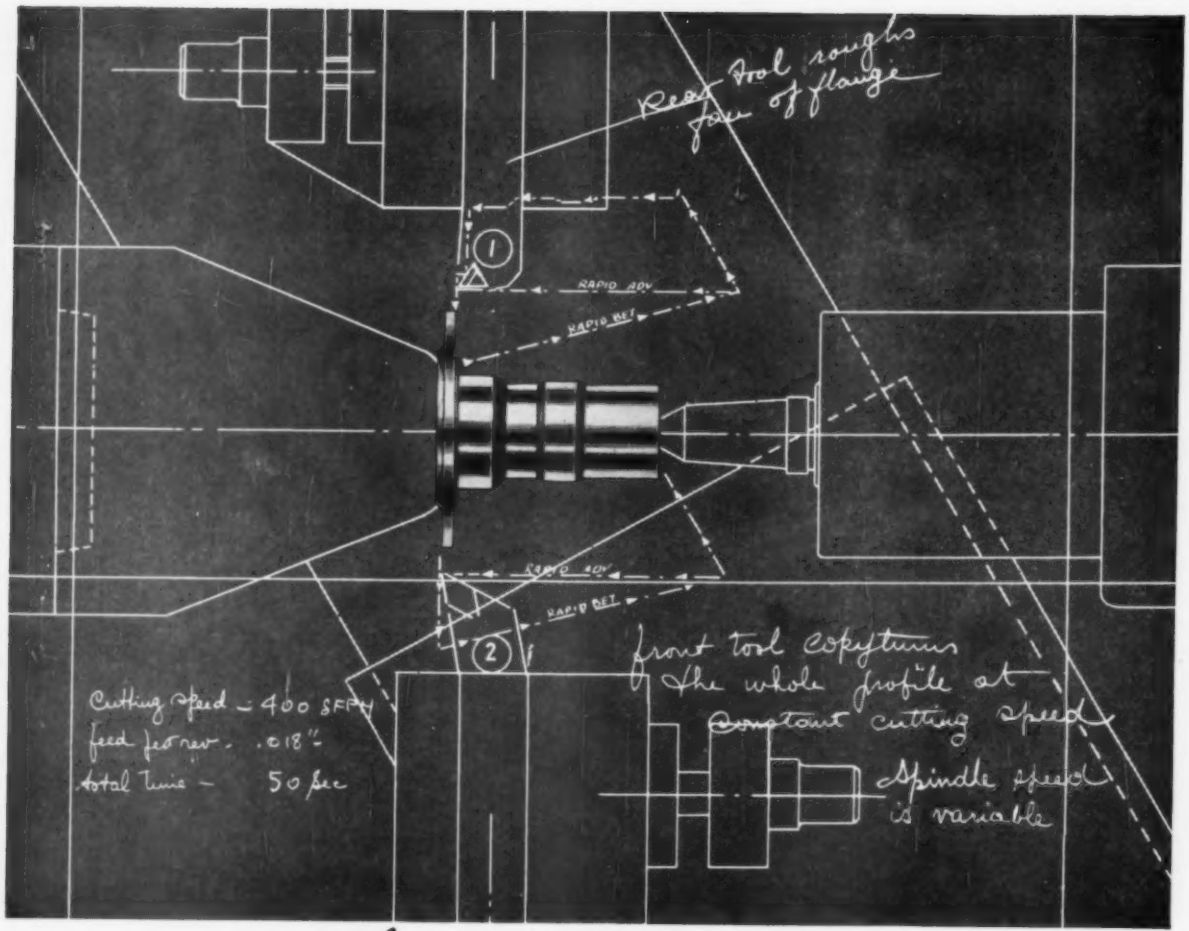
- Exclusive automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle.
- All feeds adjustable under cut. This often lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control with a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within ±.001" on most jobs.
- All way surfaces flame hardened and ground. The accuracy built in is retained year after year.
- Work piece change speeded by a single multiple position lever on tailstock. In proper sequence it controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.



Flexibility Unlimited

With such optional equipment as (1) inbuilt constant surface cutting speed, (2) automatic indexing two-position tool holder, (3) power chip conveyor and (4) chip and coolant guard.

Monarch
TURNING MACHINES
FOR A BETTER TURN FASTER... TURN TO MONARCH

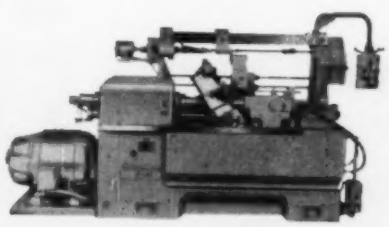

Rear tool roughs face of flange
RAPID ADV
RAPID RET
RAPID ADV
RAPID RET
Front tool copyturns the whole profile at constant cutting speed
Spindle speed is variable
Cutting Speed = 400 SFPM
feed per rev. .018"
total time = 50 sec

In 50 seconds

the Conomatic Pilot copyturns this entire profile at constant cutting speed

The Conomatic Pilot is the only multicycling copying lathe that provides constant feed per revolution by means of a piloted hydraulic feed—an important reason why you can profile turn parts like this to very close tolerances on all surfaces at full production speeds. When used for finishing only, the Conomatic Pilot can often eliminate green grinding operations.

Write today for details of the Conomatic Pilot lathe.



The Conomatic Pilot Model KU is a hydraulically-controlled multicycling copying lathe that can automatically reproduce practically any profile, using a motorized rotating template. It can be adapted to a wide variety of slides and tool stations.

Conomatic

CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

Are there any bargains in abrasives?

There certainly are. But in the abrasive field, as in many others, underselling is often a warning signal of under-par value and service.

Whenever the cut-price bait seems tempting, it's a good idea to consider what Norton offers you — in both grinding wheels and service.

You can be sure of top quality and top performance with every Norton product, because the most advanced research, engineering and manufacturing facilities in the entire abrasive field have already made sure.

For the same reasons, you can count on the consistent uniformity of Norton products. Your repeat orders for wheels of the same specifications will be filled with exact duplicates of the wheels you used before.

And filled fast! Because Norton maintains huge warehouse stocks, both regular and special, near to you. That means not only prompt, regular deliveries, but extra-fast emergency service. And Norton Abrasive Engineers, located in your area, are always ready to give you expert aid in any grinding problem.

Those are the reasons why Norton grinding wheels are your real, money-saving bargains — why they bring you the "Touch of Gold" in grinding — the Norton extra that adds product-value and cuts cost every time it goes to work for you. Remember: only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost.

•

NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

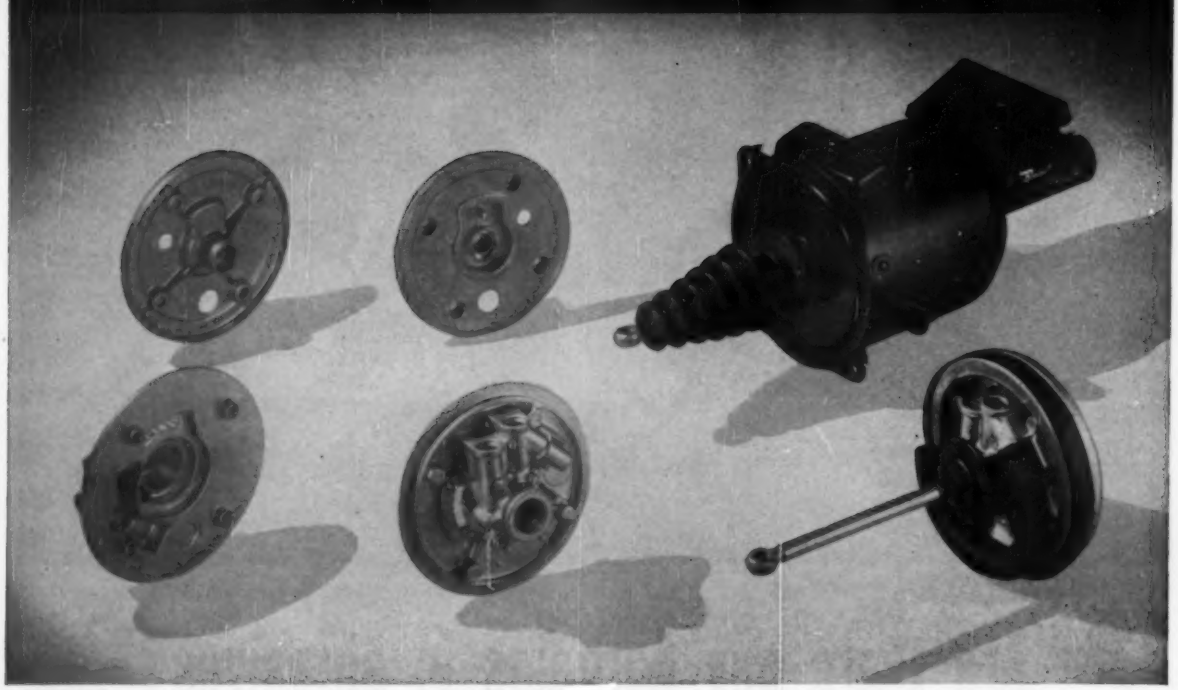
W-1961

NORTON
ABRASIVES
Making better products... to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

FOR *Eliminating Extra Parts*
AND *Extra Machining*

ZINC DIE CASTINGS ARE BEST



Bendix engineers designed this piston and control valve assembly for the Treadle-Vac Power Brake so the entire mechanism could be built around these two intricate ZINC Die Castings.

Extra parts—as well as extra machining—were eliminated by the use of ZINC Die Castings.

Front and back views of the two castings show the cored holes and bosses used in locating and fitting the internal parts. Both plates are quickly prepared for assembly by a single machining operation and locked together as a unit containing the poppet valves, springs, diaphragms and other necessary equipment.

Bendix engineers gained additional advantages by using ZINC Die Castings. Ribbing, for instance, permitted the use of metal-saving thin wall sections while providing more than ample strength for the job. They knew, from previous experience, that die life is longer with ZINC than with other die casting materials.

Why not see your die caster and find out how such parts-saving and time-saving advantages can be used in your products?

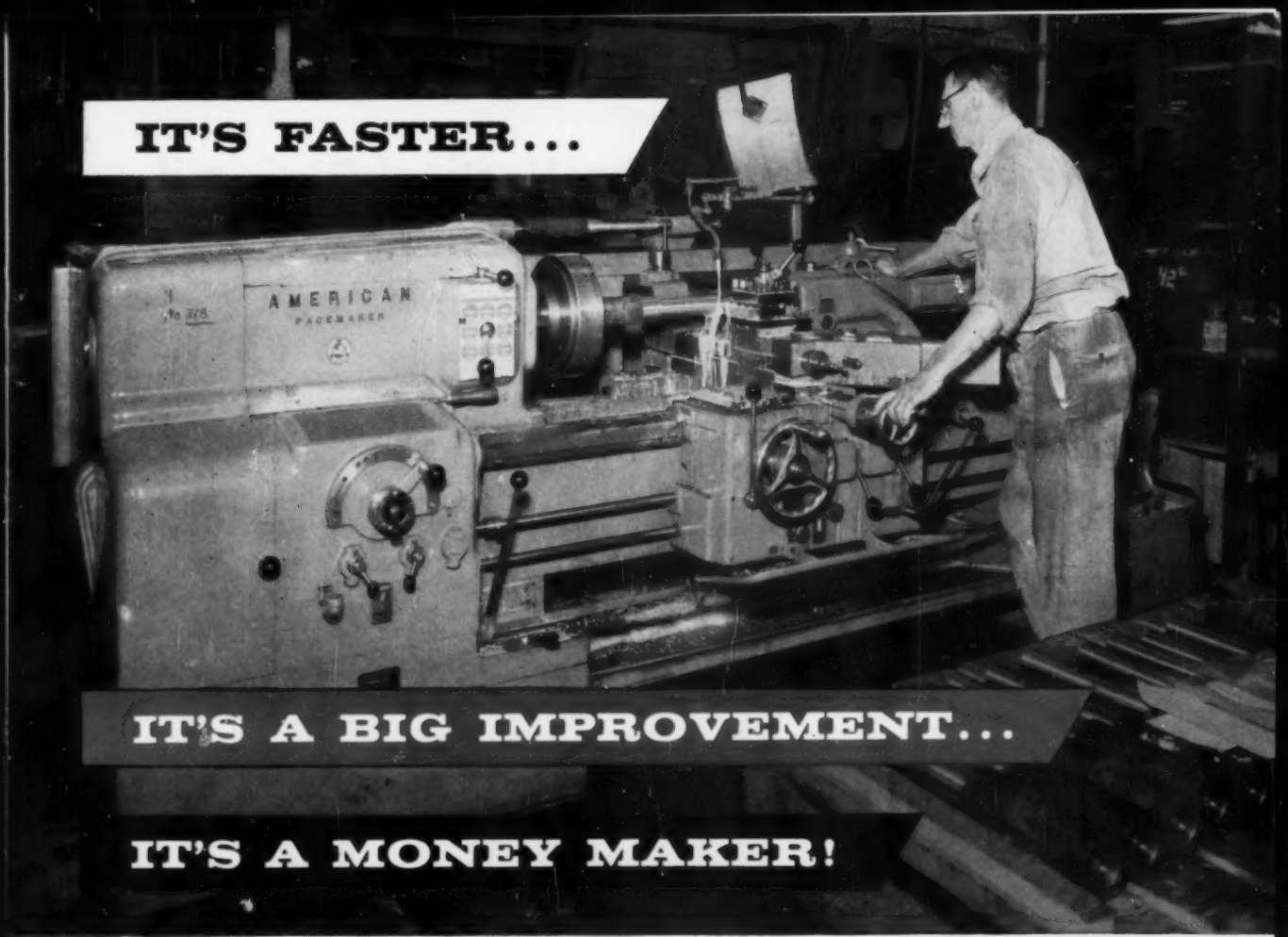
HORSE HEAD SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

DEVELOPERS OF THE MODERN ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street · New York 38, N. Y.

HORSE HEAD PRODUCTS ®



These are exact words from the production officials of The Cleveland Worm and Gear Company, of Cleveland, Ohio, which company produces the universally known and widely used Cleveland Worm Gear Speed Reducers.

The machine to which they refer is their new "AMERICAN" DeLuxe Model Hydraulic Duplicating Lathe. This lathe, as the illustration shows, is used primarily for machining worm forgings from a round template.

Accurate duplication of parts, high speeds, heavy cuts, plenty of power, quick acting air operated tailstock and ease of operation are the major characteristics contributing to the amazing productivity of this machine.

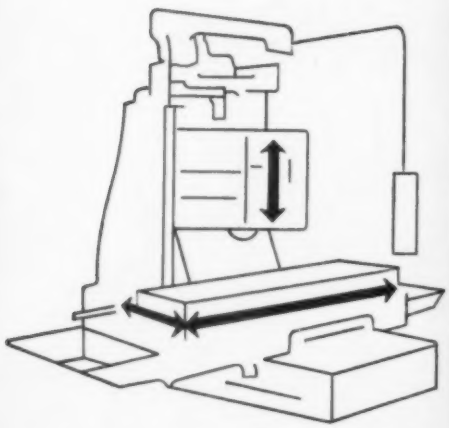
More production per man hour is the answer and only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour. Judging from reports, The Cleveland Worm and Gear Company has found this to be true.

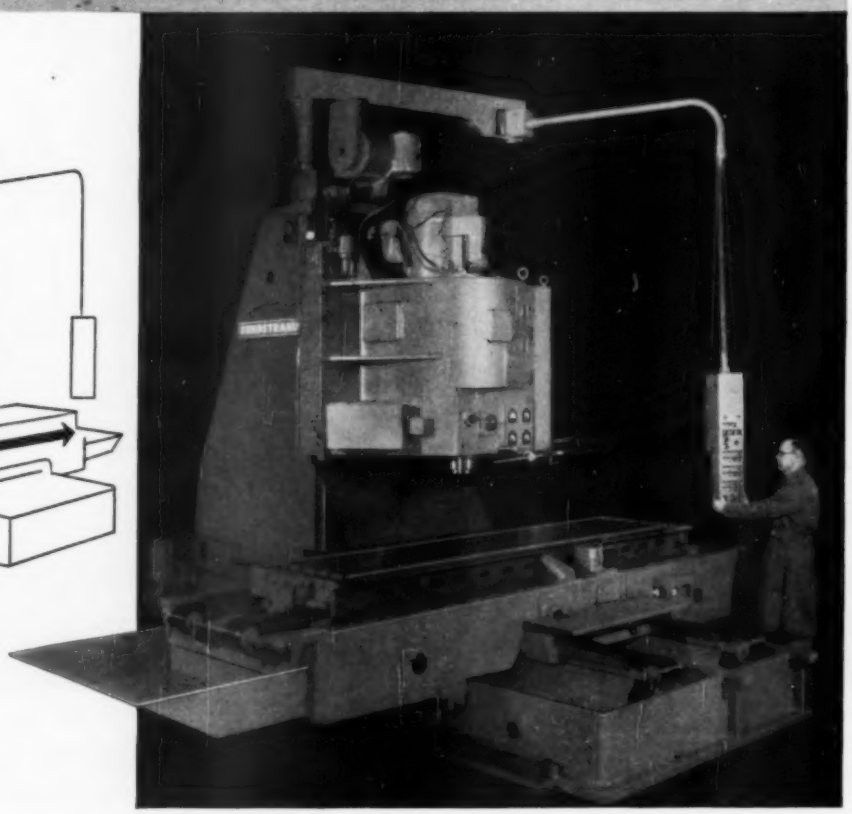
Bulletin No. 135 gives a complete description and shows many examples. It's yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

New Sundstrand 50 hp Vertical Rigidmil Provides Three Directional Feed





Transverse, longitudinal, and vertical feed makes the new Sundstrand 50 hp vertical Rigidmil an efficient producer on large work.

● Sundstrand's new vertical Rigidmil combines the ruggedness needed to handle large workpieces with workhandling flexibility by providing powered transverse, longitudinal, and vertical feed — controlled conveniently from a single pendant station. The 50 hp milling head has a speed range of 15 to 1500 rpm with speeds selected from the control pendant. Head transmits 1 hp per rpm up to maximum rated hp.

Outstanding accuracy is assured by the fixed column and fixed base design. The fixed column holds head rigidly for 50 hp cuts, while the fixed base eliminates overhang deflection and insures maximum support for the cutter for all positions of saddle and table.

Maximum height between spindle nose and top of table is 30 inches. Up to 44 inches transverse stroke of saddle and 96 inches table feed stroke enable large workpieces to be machined with maximum efficiency.

Vertical feed rate of head is infinitely variable from 3/16 to 50 inches per minute with rapid travel being 50 ipm in either direction. Transverse feed of saddle is infinitely variable between 3/8 and 75 ipm; rapid travel is 75 ipm in either direction. Longitudinal feed is infinitely variable between 3/8 and 150 ipm with rapid travel in either direction being 150 ipm. All movements are pushbutton controlled at pendant.

Write Sundstrand for more details on the 50 hp vertical Rigidmil.

SUNDSTRAND MACHINE TOOL CO.

2533 ELEVENTH ST., ROCKFORD, ILLINOIS

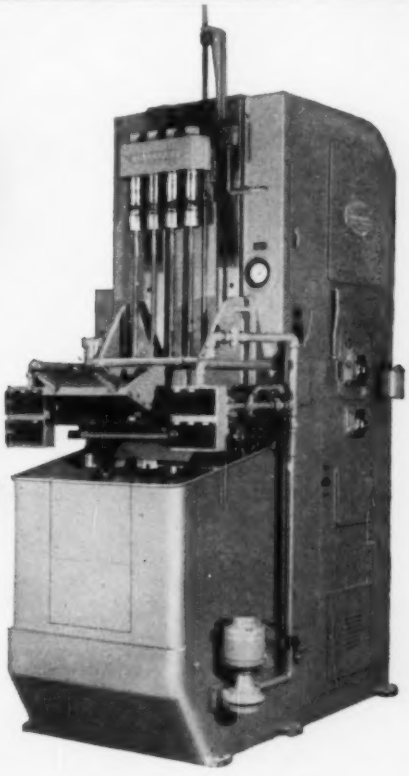
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS | TRIPLEX RIGIDMILS | SPECIAL MACHINES

SUNDSTRAND "Engineered Production" Service

American's Design Features Provide the Basis for Automatic Broaching

Splines are broached in these bevel side gears four at a time in a fully automatic cycle.

Chute feed loading on Sundstrand-American vertical pull-up machine (right) minimizes need for operator skills. Close-up at left shows four parts in broaching position and four others ready for the next cycle.



● A standard machine is all it takes to broach parts in large volume — provided the basic machine is designed to accommodate automatic features readily. For instance, a gravity chute and loading slide combine with this standard American pull-up machine for a broaching production of 1000 parts per hour. All the operator has to do is keep the four stations in the chute filled with parts — the other operations are fully automatic. All portions of the work cycle are electrically interlocked to prevent damage to the machine or tooling.

Should the part requirements change, the basic machine can be retooled for internal broaching of completely different parts with minimum outlays in time and cost. Almost without exception, Sundstrand-American's long production experience will pay off here too by keeping changes to the minimum required for peak production of the new part.

Sundstrand-American "Engineered Production" provides all three elements required by an efficient broaching installation: (1) proper broach tool design, (2) the best machine for the job, and (3) efficient fixturing. You get the manufacturing skill and engineering experience required to perform these three essential functions at no extra cost. Let Sundstrand-American show you the big difference in broaching installations.

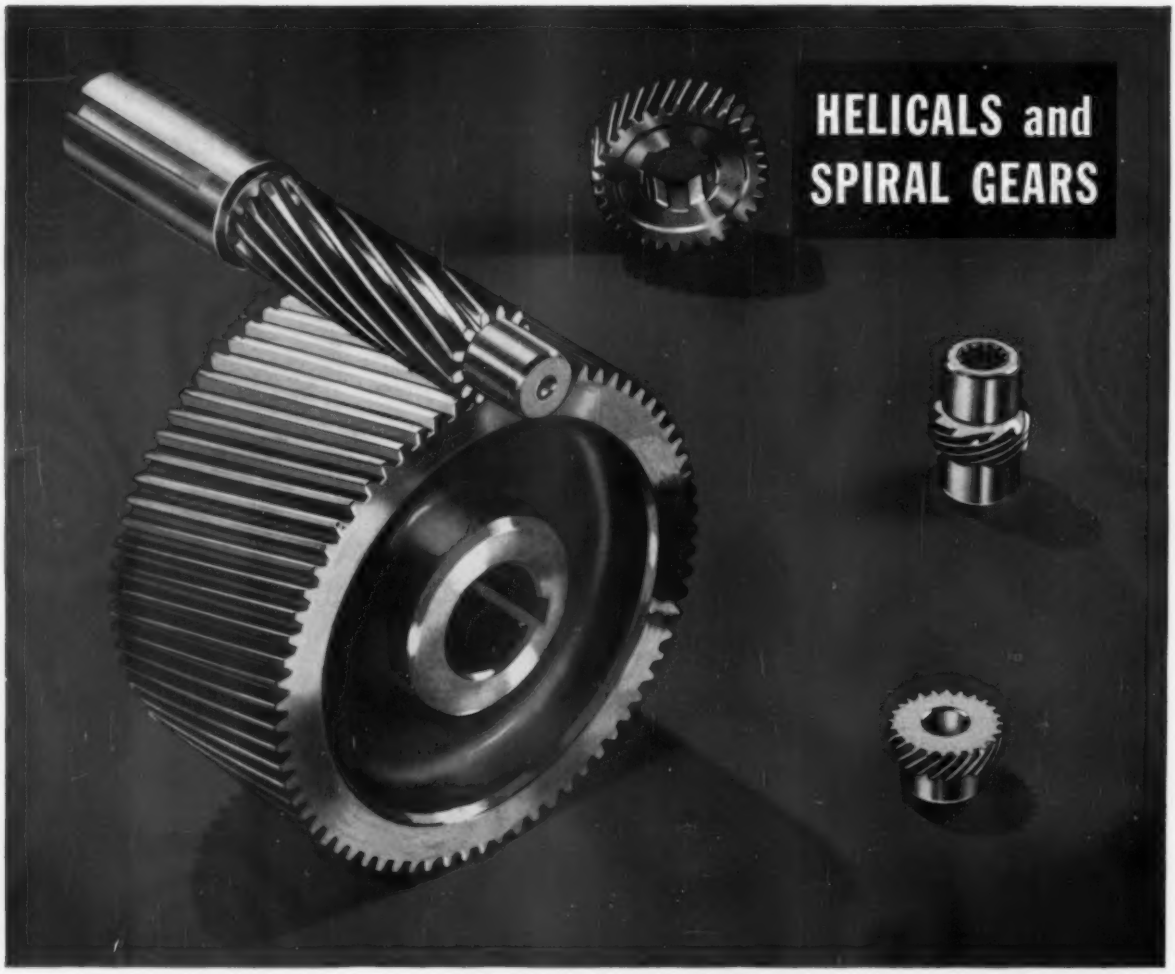
Write today for your copy of Bulletin A-128 describing Sundstrand-American vertical pull-up machines.

SUNDSTRAND-American BROACH DIV.

SUNDSTRAND MACHINE TOOL CO., ROCKFORD, ILLINOIS

BROACHING TOOLS | THREE WAY | SINGLE RAM | HORIZONTAL | DUPLEX RAM | PRESSES

SUNDSTRAND "Engineered Production" Service



SEND FOR G.S. *technical data, free! See where and how we mass-manufacture Small Gearing to uniformly fine tolerances. Folder contains 23 pictures of Small Gears, plant view, as well as Diametral and Circular Pitch Tables. Ask for your copy on company stationery, please!*

GEAR
Specialties, Inc.
2633 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS
SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

...precision-made of any material—with famous G.S. super uniformity!

Whatever basic material your application calls for, Gear Specialties can give you Helicals and Spiral Gears of consistently superior quality, made with the precision for which G.S. is famous. That means your production isn't slowed down by rejects or imperfections—and your product will perform smoothly and efficiently in the hands of your customers.

It's this unvarying G.S. quality—backed by unsurpassed experience, craftsmanship, equipment, production control—which leads top-name manufacturers in all divisions of industry to make G.S. their Number One source for not only Helicals and Spiral Gears, but for Fine and Intermediate Pitch Gearing of all types, in all quantities.

Get *your* Gear job done better—put G.S. in your picture now!

42 Years of Specializing in Small Gearing!

* **Stainless Steel welding information:**

*Keep it clean

You get strong, tight joints when you weld Stainless Steel, but you have to make sure the surfaces have been thoroughly cleaned. Any grease, oil or dirt on the welded surface might affect the corrosion resistance of Stainless.

When you want to repair a crack, it's a good idea to chip out the cracked area completely so you're sure that only clean, solid metal is exposed. And remember, there are a lot of different kinds of Stainless Steel and they don't all react the same way. Be sure you handle each job right—check the "Stainless Steel Fabrication Book" before you start. If you don't have a copy of this 130-page guide, write on your company letterhead to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

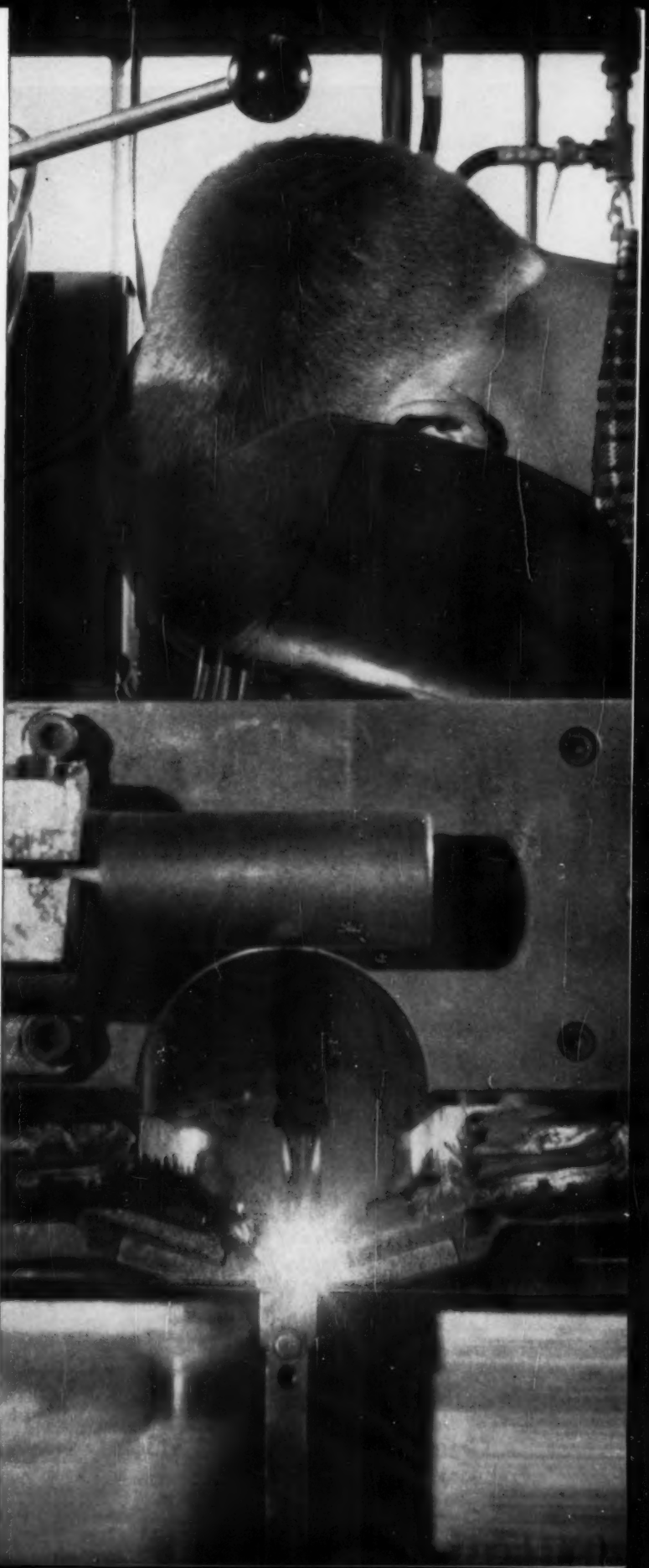
Remember: Stainless Steel isn't difficult to fabricate; it's just different.

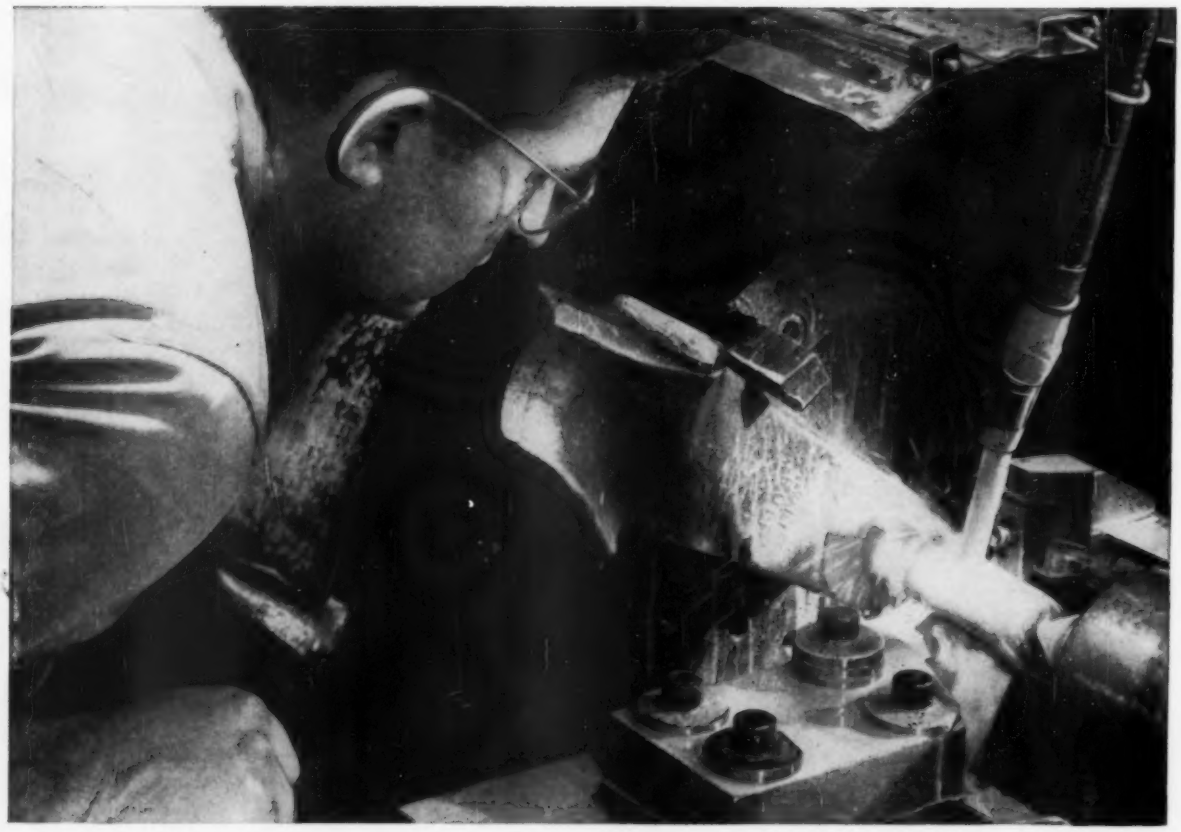
USS is a registered trademark

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Warehouse Distributors
United States Steel Export Company

United States Steel

USS





Take heavier cuts at higher speeds, even on toughest alloys—with

NEW GULFCUT HEAVY DUTY SOLUBLE OIL

Here's a heavy duty emulsifying cutting oil that consistently produces better results. Gulfcut Heavy Duty Soluble lets you make heavier cuts at higher speed—even on chrome-nickel steels and other tough alloys.

You'll get finer finishes and longer tool life, too, with Gulfcut Heavy Duty Soluble Oil. Here's why it does a better job than other emulsifying oils.

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- **EXCELLENT EMULSION STABILITY,** even in hardest water, for long life.
- **POWERFUL ANTI-FOAM AND ANTI-WELD PROPERTIES.**
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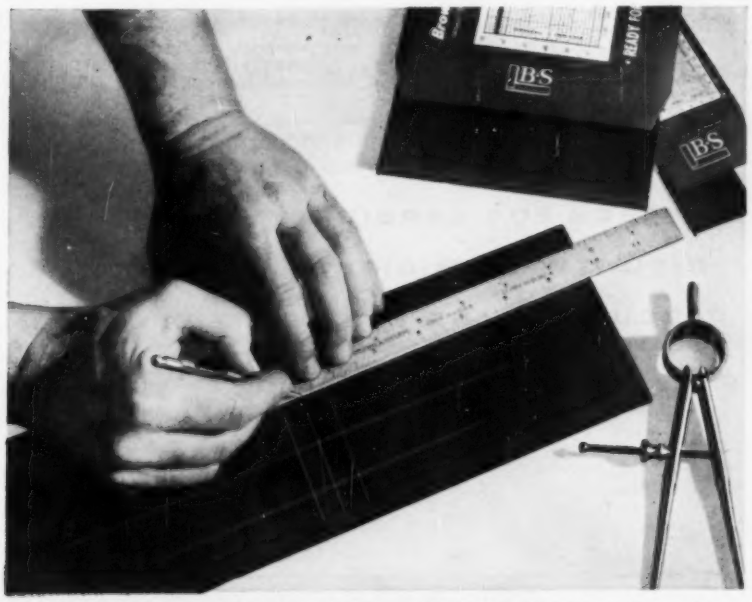
You can improve production and cut machining costs, with New Gulfcut Heavy Duty Soluble Oil. For more information, call a Gulf Sales Engineer, at your nearest Gulf office, or send for illustrated bulletin.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF

Precision Tool News

No. 5 B·S REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER



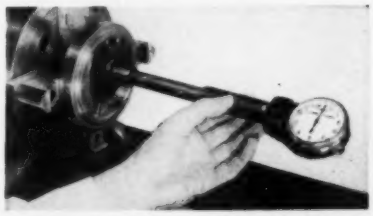
346 More Sizes of Pre-Colored Flat Stock Plus New "Thrift Stock" Add Convenience

Brown & Sharpe has more than **doubled** the number of sizes available in its "Ready Mark" flat stock . . . the popular new precision ground, oil-hardening tool steel that comes to you coated with a blue finish, all ready for scribing. Ready Mark saves about 5-minutes degreasing, bluing and drying time at each use. Now available in almost 700 sizes. Same sizes also in bright finish.

For uses where steel is not to be hardened, or when case hardening is sufficient, Brown & Sharpe announces its "Thrift Stock". This bright, easy-machining, low-carbon steel is precision ground in 255 sizes . . . saves unnecessary finishing operations . . . costs up to 60% less than oil hardening tool steel. Thicknesses from 1/16" to 2 3/4", widths to 16". 24"-long pieces, identified throughout length.

B&S Direct Reading Micrometer Speeds Measurements

Numbers appearing in plastic windows on the revolving thimble of Brown & Sharpe's new D. R. M. 200 micrometer shorten reading time by indicating .001ths directly in units of .005ths. Individual .001ths and .0005ths are then read easily from the thimble—.0001ths from widely-spaced Vernier graduations on the non-revolving sleeve. There is no possibility of "twenty-five thousandths" errors.

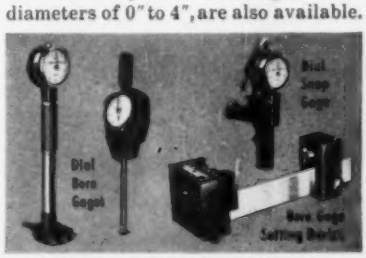


Announcing New B & S Dial Bore & Dial Snap Gage Lines

Brown & Sharpe Dial Bore Gages quickly determine to .0001" whether bore diameters are within tolerance . . . disclose bell-mouth, out-of-round, barrel-shaped and other bore conditions. Frictionless action provides high repetitive readings.

Seven sizes cover from 1/8" to 13", with no spacers or shims required. Fixed-pin equalizers assure positive centralizing in hole; handles are insulated against hand heat; and an easy-reading AGD indicator with adjustable bezel provides consistent accuracy. Available with tool-steel points in carrying case. Carbide or diamond points available.

Easy-to-use B&S Bore Gage Setting Devices are perfect companions that simplify setting of the Dial Bore Gages . . . eliminate the need for inventories of ring gages. B&S Dial Snap Gages, offering similar advantages of speed and accuracy for checking outside diameters of 0" to 4", are also available.



Ask Your B&S Distributor to show you these tools

Brown & Sharpe precision tools are available to you quickly, at factory prices, through your nearby B&S Distributor. Call on him for experienced help in any of your precision tool needs. Brown & Sharpe Mfg. Co., Providence 1, R. I.

PROGRESS IN PRECISION FOR 125 YEARS

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ROCKFORD ECONOMY
LATHE

A complete description of this modern, medium-sized, economy-priced lathe designed with . . . .

SPEEDS FOR CARBIDES

RIGIDITY FOR HIGH PRODUCTION

ACCURACY AND FLEXIBILITY FOR TOOLROOM USE

16" AND 18" SWING

ROCKFORD ECONOMY

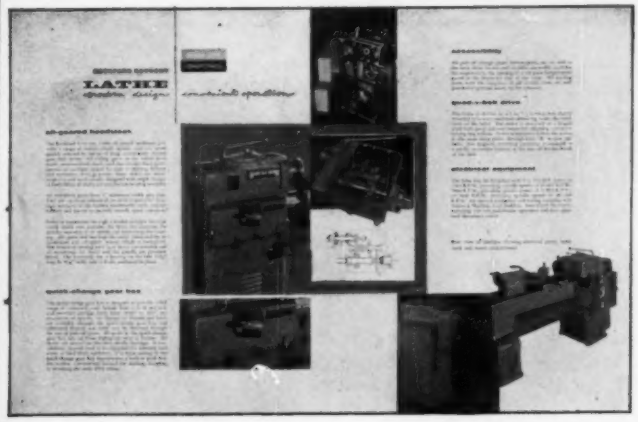
LATHE

a rigid, powerful engine Lathe **in a medium-sized, economy-priced class**

The Rockford Economy Geared Head Lathe is designed to fill a specific demand for a medium priced lathe of sufficiently heavy construction to stand up under general production and maintenance use, while providing the accuracy needed for the tool room. Its ruggedness are ample and it is powered for use with carbide tools. High quality materials are used liberally and judiciously in its construction. This lathe is built by expert machine tool mechanics on an economical quantity production basis.

The Rockford Economy Lathe has a big, accurate head screw, uninterrupted by keyways, an independent feed shaft with nonbinding safety clutch, a handy thread cutting dial as standard equipment, double wall apron, drop lever feed engagement and every essential of a first-class lathe. The geared head has 12 easily obtained spindle speeds. Headstock shafts and spindle run in Timken precision bearings.

Read our guarantee and check the specifications. Buy Rockford Economy Lathes for real economy in turning operations.



This completely new booklet contains photos, description and drawing of the all-geared headstock with quick-change gear box, standard construction features, and description of spindle, carriage, apron and taper attachment, together with a complete list of specifications and extra equipment.

Every methods and process engineer should have a copy for comparison of production and accuracy lathe values. This bulletin also makes it easily apparent how to specify lathes equipped to meet specific production problems through selection of size, feed and speed range, and electrical equipment. Full description is also available on tracer controlled operation with the Rockford Kopy-Kat Duplicator.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

get a copy-
ask your distributor

There's a Rockford Machine Tool Co. representative in your area who will quickly send you a personal copy of this new booklet for reference and file. If you are a methods, process or production engineer, master mechanic or production superintendent drop him a line on your company letterhead, or write us directly for Bulletin No. 904.

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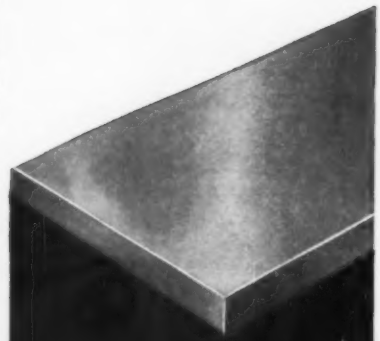

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GROUND FLAT TOOL STEEL
is ready to process
without further grinding

- Guaranteed free from decarburization
- Oil hardening, non-deforming type AISI No. 01
- Wide hardening range from 1425° to 1500°
- Ground to a surface finish of 25 micro inches
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THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Lunch "hour"

Dear Sirs:
I read William Raisglid's "WANTED: an hour for lunch" (*AM*—June 2 '58, p97) with the greatest of interest.

An hour for lunch? I am all for that. Having grown up in Europe, I have even enjoyed a 2-hr lunch break, working from 8 to 12 and from 2 to 6. The American 30-min quick lunch break may be a great time saver, but in practice this custom is barbarous and nerve-wracking.

Undoubtedly, the 30-min lunch break stems from the desire of all victims of industrialization to get away from it all and to head toward home and comfort at the earliest possible moment.

A switch to a 1-hr lunch period would require a thorough reassessment of policies which have long been standard for American plants. At least limited recreational facilities would have to be provided. Up to this moment hardly any American factories provide more than a plant cafeteria, while Mexican industry has recognized the need for pleasant and enjoyable surroundings for its employees. American workers usually eat their own lunch right next to their machines, perched on a fragile box. Some of them sit on sidewalks to get at least a breath of fresh air.

Such an undignified way of spending the lunch "hour" is highly resented by more sensitive and skilled workers. Some are resigned to this situation which they consider just another example of how little their employer really cares for their welfare and comfort.

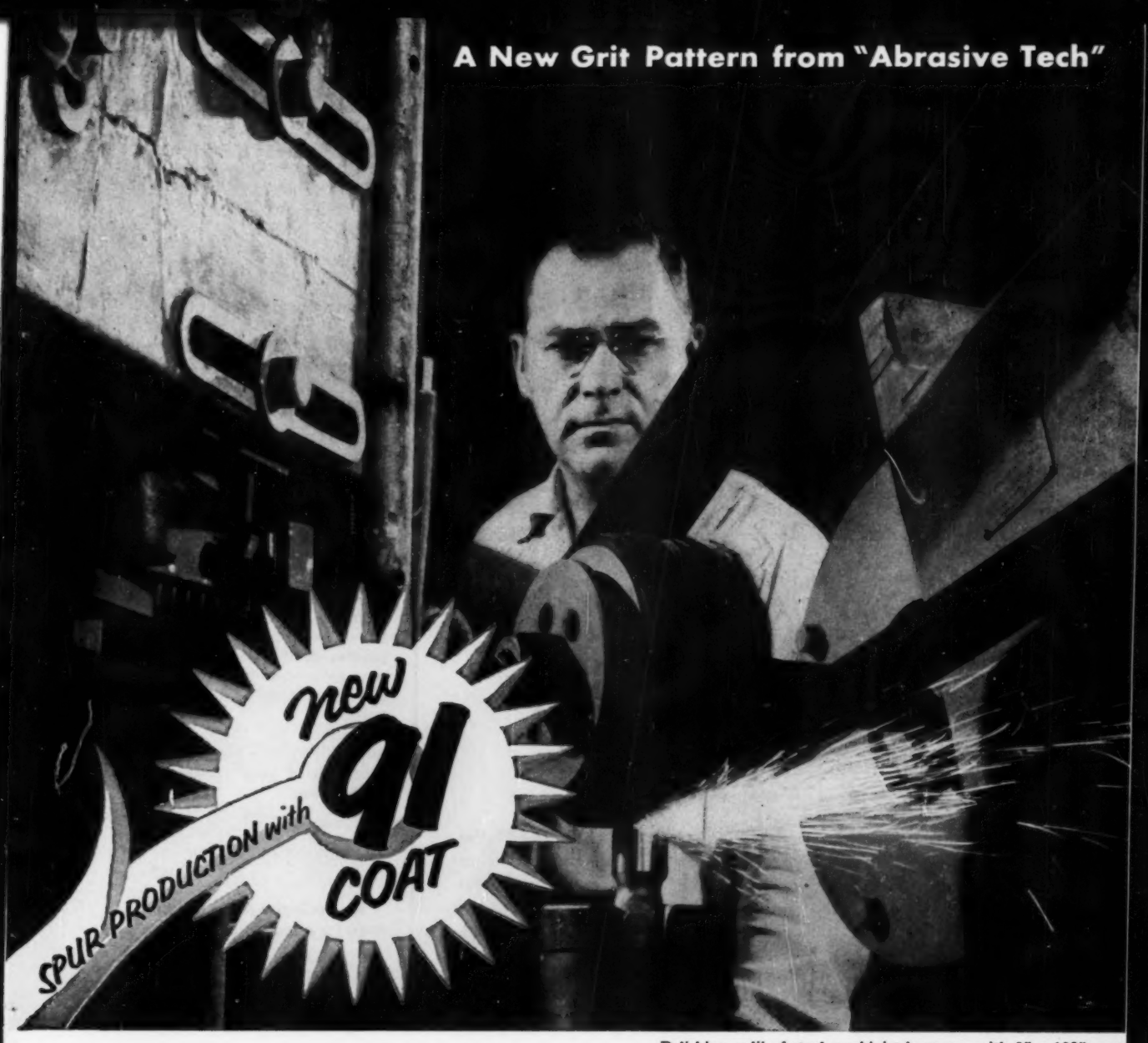
What is undoubtedly needed is more social lounges with adequate chairs for reading and conversation, a garden with sun and shade, perhaps even a swimming pool, games, and limited sports facilities to help employees really relax, rest, and enjoy themselves. Too many executives are opposed to such ideas because they feel employees nowadays "have it much too good anyway."

If a relaxing lunch is good for executives, it ought to be good for all employees. Greater company loyalty, less antagonism, better and more efficient produc-

SHOPMATES

N. Jarvis

PLACE IS OVERRUN WITH WIMMEN! GITTIN' SO YA CAN'T "TALK" TO YER WORK WITHOUT SOME DAME SAYIN' YER SWEARIN'!! WIMMEN WASN'T ALLOWED IN A TOOL ROOM IN THE GOOD OL' DAYS!!
HE'S SORE BECAUSE THE GALS DIDN'T START WORKIN' UNTIL HE'S TOO OLD TO ENJOY HAVIN' 'EM AROUND!
N. JARVIS



Polishing radii of steel machinist hammers with 3" x 120" new 91 Coat RESINALL METALITE Cloth Belts jumped production.

Production News for the tough jobs —91 Coat Resinall Metalite Belts!

It's the hardest working, fast cutting abrasive in the metalworking industry. You can actually *see* the difference . . . 91 Coat is so outstanding, so much rougher and sharper. For more production, more mileage per belt . . . try 91 coat abrasives on your toughest jobs. Write for a demonstration in your plant or at your nearest Abrasive Tech Methods Room.

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TROY, N. Y.

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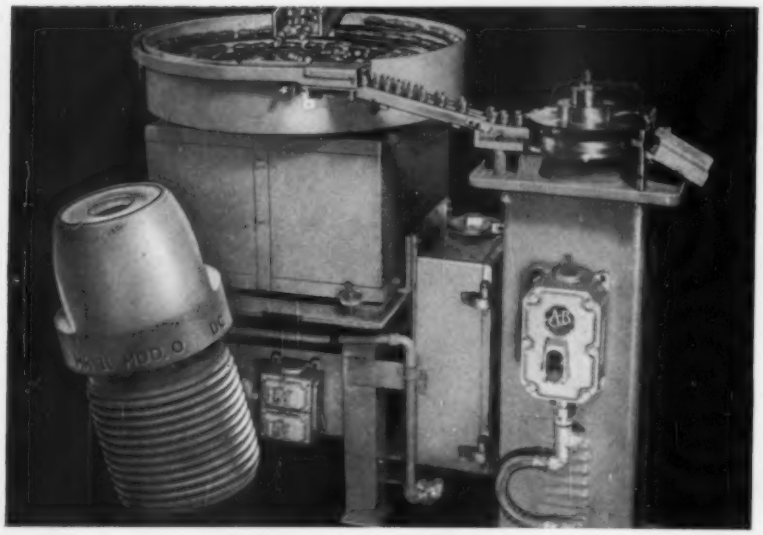

Automation
IN MARKING

MARKS
7500 PIECES
PER HOUR

Capable of speed-marking 7500 parts per hour, this hopper and dial feed machine is just about the nearest thing to automation in marking. As illustrated above, Model 435 features a vibratory parts feeder, 30" bowl and dual track carrier. Parts are fed to the machine from the bowl, then permanently marked and automatically ejected. Spring pressure controls depth of mark and insures clear uniform imprint. Ideal for speed-marking solid, round heavy walled or conical parts. Like all Noblewest Roll Marking equipment, it produces permanently indented impressions . . . good for the life of your product . . . at *faster speed and lower cost.* This is but one of Noblewest's comprehensive line of machines for marking round, flat, and irregular surfaces. For detailed information write Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Connecticut.

Noblewest is equally famed for tools, fine marking dies, and fixtures.

COMPREHENSIVE CATALOG WILL BE GLADLY MAILED ON REQUEST

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
ORIGINATORS OF THE ROLL MARKING PROCESS
MARKING
NUMBERING
EMBOSSING
GRADUATING

tion with fewer accidents would result.

As I see it, there is no question that a comfortable 1-hr lunch hour eventually will replace the quick-lunch torment. It is just a matter of time.

Walter Gerstel
Berkeley, Calif

Small press!

Dear Sirs:
I would like to bring to your attention a typographical error in the article on linear programming as a tool for small business (*AM*—June 16 '58, p110).

The key equipment in the type of aluminum extrusion plant described in the article is a 1250-ton hydraulic extrusion press. The article inadvertently mentioned a press of 120 tons capacity.

As a matter of fact, there are scores of extrusion presses of 1250 tons capacity in production throughout the country, while presses in the size range of 120 tons are seldom used for commercial production of aluminum extrusions.

Perhaps, for the record, you might bring this comment to the attention of your readers in the near future.

Stanley Spiegelman
Loewy-Hydropress Div
Baldwin-Lima-Hamilton Corp
New York, NY

We apologize to Author Spiegelman for allowing this error to slip by—Ed.

Helpful Henry

by L. Hoppes

"Sit down and rest your feet awhile. Oops, no top on it!"

CALENDAR

National Tool & Die Manufacturers Association — Summer Meeting, July 23-26, Mt Washington Hotel, Bretton Woods, NH.

Society of Automotive Engineers—Farm, Construction, and Industry Machinery Forum and Display, Sept 8-11, Milwaukee Auditorium, Milwaukee, Wis.

Instrument Society of America—Annual Instrument-Automation Conference and Exhibit, Sept 15-19, Convention Hall, Philadelphia, Penna.

Society of Automotive Engineers—Aeronautic Meeting and Display, Sept 29-Oct 3, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers—Semiannual Meeting and Western Tool Show, Sept 29-Oct 3, Shrine Exposition Hall, Los Angeles, Calif.

American Society of Mechanical Engineers and American Society of Lubrication Engineers—Lubrication Conference, Oct 14-16, Statler Hotel, Los Angeles.

Society of Industrial Packaging & Materials Handling Engineers—Annual Meeting and Exposition, Oct 14-16, Chicago Coliseum, Chicago, Ill.

American Machine Tool Distributors Association—Annual Meeting, Oct 16-17, The Sheraton Plaza, Boston, Mass.

Magnesium Association — Fall Meeting and Exhibit, Oct 16-17, Fort Shelby Hotel, Detroit, Mich.

Metal Treating Institute—Annual Meeting, Oct 17-19, Sheraton Hotel, Philadelphia, Penna.

American Gear Manufacturers Association—Semiannual Meeting, Oct 26-29, Edgewater Beach Hotel, Chicago, Ill.

American Institute of Mining, Metallurgical & Petroleum Engineers—Fall Meeting, Institute of Metals Div, Oct 27-31, Carter Hotel, Cleveland, Ohio.

American Society for Metals—National Metal Exposition and Congress, Oct 27-31, Public Auditorium, Cleveland, Ohio.

NEW! Two Cylindrical Die Type

THREAD ROLLING MACHINE

HORIZONTAL TYPE

Especially Suited for Job Shops

for Both In-feed and Thru-feed Rolling

The use of highly skilled setup and operating personnel is not required, because of the simplicity of operation and of changeover from one job to another. A cam-actuated head feeds the dies into the work and a fine micrometer adjustment provides for accurate final sizing. Can be used for manual, semi-automatic or completely automatic feeding.

Supplements widely used Reed cylindrical die thread rolling machines of the three die type.

DIAMETER CAPACITIES

In-feed - up to 2 inches

Thru-feed - up to ¾ inch

REED

Write for Machine Bulletin B 111-1

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

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TRM-186

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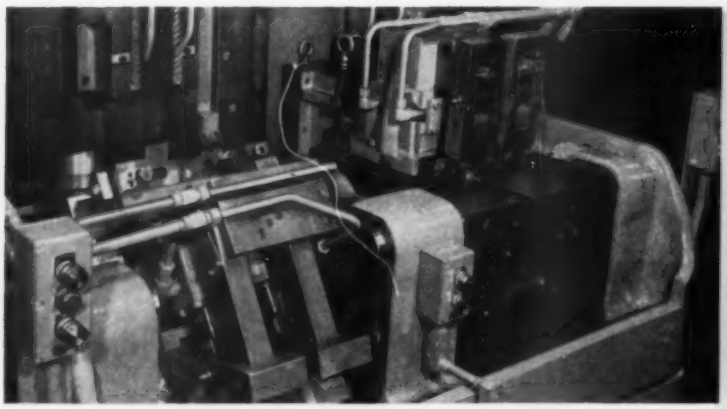

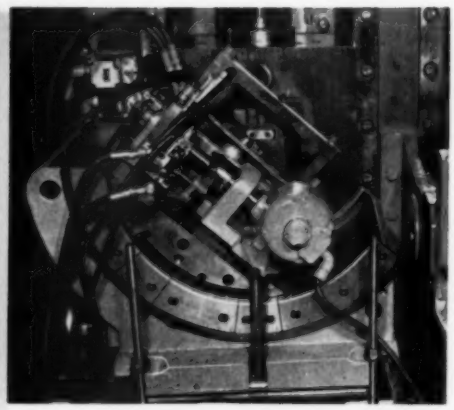

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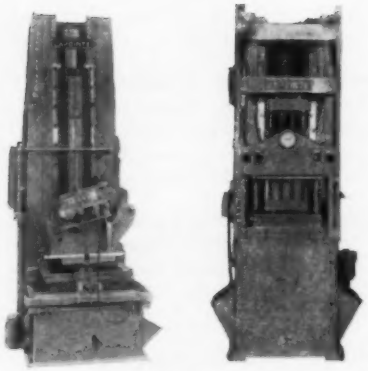
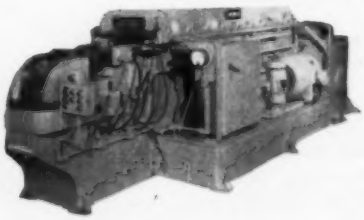
56 years of valuable experience

in building broaching equipment exclusively. This is a sound background, more than is available anywhere else! With the engineering know-how, and our skilled mechanics, we can be responsible for the complete rebuilding and re-tooling job.

Don't shop around for price. It may actually cost you more in the end in inferior work, and possible failure of your broaching operation.

The Lapointe *full guarantee* applies to each rebuilt Lapointe machine and fixture. Get our estimate for rebuilding or re-tooling any of your broaching equipment.





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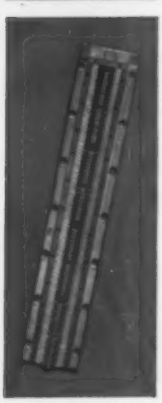
SPOT NEWS...

- **Research on orthogonal cutting of steels with carbide and ceramic tools** will be undertaken by the University of California for Army Ordnance soon.
- **General Motors is offering $1000 reward for saboteurs** who have damaged 176 auto bodies at its Fisher plants in Flint, Mich, and Kansas City, Mo. Chrysler reports similar incidents, as well as recurring wildcat strikes, at its Plymouth plants.
- **Russia could surpass the U S in automation and techniques by 1970** unless this country places more emphasis on those fields, according to Ford's Nevin Bean. Russian lab equipment is as good and often better than American, he says, and so is its technical training.
- **Adjustable carbide chipbreaker on a toolholder for throwaway tips,** developed in Sweden, has serrations on its top face that allow positioning to correct depth relative to feed of tool. Spring-loaded pin holds the chipbreaker in position against toolholder clamp during indexing or changing of the toolbit.
- **Missile spending will reach 40% of the U S military budget** in the next three years, according to Air Force's General Nathan Twining.
- **Appliance makers are afraid of a squeeze if steel prices go up.** Says one: "The public just won't stand for an increase in the price of our products—it looks like we'll have to absorb higher steel prices ourselves."
- **Ford's Windsor, Ont, plant is going into production of 6-cylinder engines,** built in the U S until now, for Canadian Fords. It's part of a $4-million re-equipment program begun in 1956. The Windsor plant has been making V-8 engines since 1932.
- **Production is below capacity in 76% of 554 British companies** surveyed by the Federation of British Industries recently. Although output is being maintained at February levels still, profit margins are falling, order books are shorter, and labor is easier to find. Capital spending plans are down, too, this year compared with 1957.
- **Tough heat-resistant alloys can be punctured by chemicals and electricity** instead of by cutting tools with a new technique developed at GE's Engineering Lab, Schenectady. Glass tube containing chemicals is lowered over metal, not touching it, and electro-chemical machining punctures the metal.
- **Sweden's SKF has ordered a fully automated machining line** from Czechoslovakia's TOS Werke. Within 3.5 min, line carries out 44 separate machining operations on cast iron shells and housings for railway bearings. Electro-magnetic counters keep a check on line's operation.
- **Checker Cab will be out with its long-awaited passenger car in August.** It will be a 120-in. wheelbase job (longer than any in the low-price field) but will be only 200-in. long (shorter than any U S car except Rambler). Engine is an OHV six made by Continental—powerful enough to propel the car at 103 mph. Approximate delivered price: $2350.
- **Germany's Daimler-Benz will start production of autos in Brazil** by the end of this year. They'll be similar to the company's German models.

Spot index to major News stories...

How Soon Would 5-Year Writeoff Boost Spending? 86
Now . . . Ti Alloys You Can Form and Harden 87
No Recession for Shipbuilders 90
Russia Revisited—An On-the-Spot Report 91
Washington 67
Detroit 69
Aircraft & Missiles 71
Machine Tools 73
Materials 75
What's Ahead in Metalworking 77
in Business 78
Field Report 146
Names in the News 159

The unusually large broach produced for a heavy equipment builder is given careful final inspection by Continental Tool engineers before shipment.



Ever seen a broach this big before?

HERE'S HOW IT WAS MADE—AND WHY

It takes a large tool to broach accurate involute splines in an 8.040" diameter by 4.750" long hole in one pass in a steel part.

Yet that's exactly what the mammoth broach shown above is doing today for a major producer of heavy earth-moving equipment. Its size alone — 8"-plus diameter by 74" length—makes it one of the largest of its kind ever produced by Ex-Cell-O's Continental Tool Works. To make it, required a series of critical manufacturing operations highlighted by the hardening process applied to the shell main body.

One more example of how Continental engineers, plant personnel and facilities team to deliver broaches tailored to meet manufacturers' requirements. Perhaps you have a specific problem you'd like to discuss with them. Simply call your local Ex-Cell-O representative—the service costs you nothing, of course.

Continental

CTW

TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

57-69

WASHINGTON...

East-West trade...

Despite new plans to ease restrictions on Free World trade with the Soviet Bloc (approved by the US and allied nations at the Paris export control talks), Washington officials expect the softer policy to have little if any impact on the volume of US shipments to Russia, because:

- The Russians still seem unwilling to pay for US goods in gold. The US, on the other hand, has little need for the raw materials Moscow wants to export here—chrome, manganese, ferro alloys, iron ore, and such.
- The Russians would be most likely to continue so-called "prototype buying" of the most advanced machinery and equipment. This would mean small-lot one-shot orders for items of the latest design, which in turn would be copied in Russia for production there. This is the policy followed through the 1930's and reflects Russia's continued reluctance to become dependent upon Western sources of supply for key materiel.
- The equipment the Russians want the most from the US—latest electronic gear and metalworking machinery—is apt still to be banned for export in this country, even though Western European producers are now allowed to ship such items behind the Iron Curtain.

West European and Japanese trade with the Soviet Bloc is likely to increase, however, as the result of the liberalized export policy. The West European countries and Japan will not encounter payment problems in increased Soviet trade—they can use the raw materials Russia wants to sell more readily than we can.

Besides, our Free World allies are apt to interpret export controls far more liberally than we do. There is greater political pressure in these countries for a step-up in trade with the Soviet—many of our allies are more dependent on export markets than we are.

Still, the real problem is this: the actual extent to which Khrushchev wants to try to increase East-West trade. In view of the latest toughening of Soviet policy on East Europe and a Summit conference, future Kremlin policy is tough to anticipate.

Army procurement plans...

The Army has laid out details of its hardware procurement plans for the new fiscal year. The program totalling close to $2 billion, includes plans to buy: 24 Sikorsky H-32 Mojave medium cargo helicopters costing $29 million; 60 Bell UH-1 Iroquois light utility helicopters costing $31 million; 176 Bell 47G Sioux reconnaissance helicopters costing $11 million; 31 Grumman OA-1 Mohawk medium observation planes costing $33 million; 100 DeHavilland Beaver light utility planes costing $6 million; and 29 DeHavilland U-1A otter cargo planes ($3 million).

Missile procurement, amounting to over $700 million will cover Chrysler's Redstone, Sperry's Sergeant, Martin's LaCrosse, the Emerson-Douglas Little John, Utica-Bend's Dart, the Raytheon-Northrop Hawk, and the Western Electric-Douglas Nike Hercules.

Aids to small business...

New federal assistance for small business seems certain to be passed before the Congressional adjournment this summer. As *American Machinist* went to press, the exact form of small business aid was still being debated in committee.

But chances are strong that Congress will buy most of a two-part program:

First, loans for small business. The Senate has already voted a $250-million "Capital Bank Act" to provide loan funds to small firms for purchase of capital equipment. A slightly different version has been reported out by the House.

Both measures would authorize the Small Business Administration to charter private investment companies to make loans to small companies for capital equipment expenditures. SBA would also be authorized to make loans to state and local authorities for the same purpose.

Second, tax relief—(1) extension of rapid depreciation allowances for purchase of up to $50,000 on used machinery and equipment; (2) allowing small corporations—those with, say, no more than 10 stockholders—to be taxed as partnerships; (3) granting a 10-year payment period for estate taxes where the estate is made up mainly of investments in a closely held corporation (now due 15 months after death); and (4) boosting the $1000 limit that original investors can deduct as capital losses.

Ex-Im loan to Brazil...

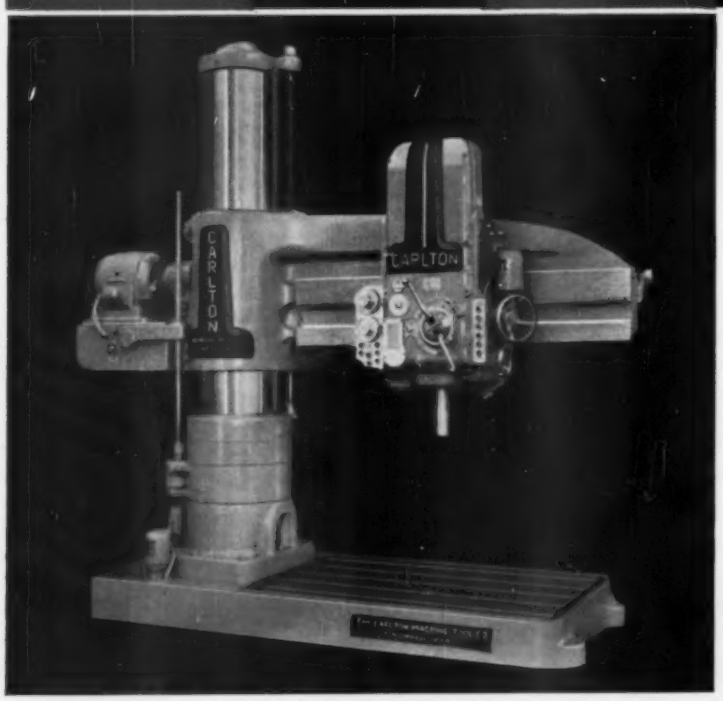
The Export-Import Bank has granted Brazil a $4.5-million line of credit to finance 90% of the cost of lathes, drills, milling machines, grinders, shapers, electric welders, and other industrial equipment to be bought from US producers for use in Brazilian training schools. The credit is authorized to "Senai"—the National Service of Industrial Apprenticeship—a private corporation sponsored by the Brazilian Confederation of Industries to operate industrial training schools. The borrower will make a cash payment of 10%.

Model	Column diameters	Arm lengths	Speeds No.	Speeds Range	Feeds No.	Feeds Range	Motor recommended
0A	9"	3'-4'	9	20 to 1	4	.006-.020	3-hp
1A	9" 11"	3'-4' 3'-4'-5'	12	25 to 1	6	.006-.025	5-hp 5 or 7½-hp
3A	13" 15" 17"	4'-5' 4'-5'-6' 5'-6'-7'	36	100 to 1	18	.004-.125"	7½, 10, 15, 20 or 25-hp
4A	19"	6'-7'-8'	36	100 to 1	18	.004-.125"	15 to 40-hp
5A	22" 26"	7' to 10' 8' to 12'	36	100 to 1	18	.004-.125"	20 to 40-hp†

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.
†Driving motor larger than 40 hp can be used if desired.

Carlton . . . the modern design radial drill

0A 1A 3A 4A 5A



Only at Carlton can you take your choice of

- 5 different models of radial drills
- Column diameters from 9" to 26"; arm lengths from 3-ft. to 12-ft.
- 5 different types of speed-feed controls (3A, 4A and 5A models)

For the utmost in versatility, you can choose the Carlton Programming System that lets you pre-set speeds and feeds for a complete drilling sequence of 20 or more operations.

For production operations involving fewer and less complex drilling sequences you can select from among three speed-feed controls that help make the machine more productive: Pre-select, Power range Pre-select and Partial Pre-select.

And in manual control, Carlton's simplified pushbutton control head is the most modern in design and easiest to operate.

There's no compromising at Carlton . . . where you select the radial drill that fits your requirements exactly. Write today for bulletins describing the sizes you need. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *Specialists in radial drills*

DETROIT...

The durable six...

At the height of the horsepower race in 1956, most auto pundits had written off six-cylinder engines as anachronisms suitable only for taxicabs. Output of this option for all makes involved was dropping steadily.

Now, looked at relative to the industry-wide depression, sales of sixes are booming. Figures show only a 7% drop from last year, compared to an overall sales decline of over 22%. On a percentage-of-production basis, the figures from some companies are startling. Ford, for example, reports sixes currently accounting for 25.7% of output compared to 13.3% last year.

Statistics such as these have caused some soul searching among engineers responsible for power plant design. Existent six-cylinder engines are for the most part obsolete designs. Only Ford's is relatively modern, having first been introduced in 1952. Chevrolet's version has undergone so many modifications that the original basic design is unrecognizable but it dates back to the 'thirties. Plymouth's unit, also used by Dodge, is about as old chronologically and is further handicapped by its L-head-type construction.

What to do about this is the subject for annual debate, but never more so than this year. Engineers can continue to putter around with minor refinements on present engines, except that the point of no return is near. They could design all-new engines of unorthodox construction and cylinder arrangement. However, the six or its replacement for the standard-sized car must always be readily interchangeable on the production line with the V-8, so radical engineering innovations are all but ruled out in this field.

OHV for Plymouth?

The next course for Plymouth is clear. Like Rambler did a few years back, Plymouth engineers can tack an overhead valve structure on the existing block and achieve measurable gains in efficiency.

Standard-size six-cylinder design activity at Ford is almost dormant at the moment, but some engineers there are eyeing possibilities of an aluminum version of the existing engine. It could be made, they say, with only minor tooling adjustments.

Chevrolet, on the other hand, feels that an aluminum version of their six-cylinder engine would require complete redesign. The project is shelved temporarily in favor of backtracking on the displacement of the existing unit.

Who's a gas hog?

Rambler's claim to 30-plus-mpg economy has been pretty well substantiated in recent years by persistent wins in the annual Mobilgas economy runs, as well as in company-sponsored cross-country trips sanctioned by Nascar. In fact, Rambler has done so well that it has been banned from the last two Mobilgas events—on the flimsy grounds that it isn't a "full-sized" car. This rule was aimed at the regular Rambler, not the smaller American, which hadn't been introduced at the time.

Rambler's advertising cracks at "gas hogs" and "Dinosaurs in the Driveway" began to needle the Big Three, who claimed they had economical cars in their line but the public wouldn't buy them. Then, as Rambler sales ballooned 78% this year, the needle became a hot poker.

Highway-speed economy run...

With the idea in mind of proving that a six-cylinder Ford was at least as economical as a Rambler, Ford arranged Nascar sanction for an economy run at highway speeds from Detroit to Key West, a distance of 2213 miles. One each Ford, Chevrolet, Plymouth, Studebaker, and Rambler six-cylinder cars were chosen "at random" from dealers.

Ford squeaked in the winner by a thimbleful, which is perhaps why subsequent advertising of the event is vague—to say the least. Official mpg results were: Ford—20.3535; Studebaker—20.3498; Chevrolet—19.9860; Rambler—19.4264; and Plymouth—17.3033. Total fuel, oil and lubrication costs for best and worst cars differed by less than $6.

The cars were penalized by not being equipped with overdrive, but this favored an available Ford rear axle ratio of 2.69, the highest and therefore most economy prone, in the event. Drivers were professional and the high average speed was certainly more realistic than the usual plodding economy run pace. Nevertheless, the results serve only to prove that there are at least four cars made in America today that are quite economical to operate. If testers were to repeat the run with five different cars of the same makes, the results could easily be upset by normal production variations.

51% More Production

when drilled with the

BENCH MODEL BURGMASTER®
Turret Drilling Machine

JOB DATA:

Part: Gas furnace pilot burner head.

Location: General Controls Co., Glendale, Calif.

Material: Type 2202 stainless steel.

Operation: Drill 10 holes No. 56 drill size.
Drill 1 hole No. 42 drill size.
Drill 1 hole No. 37 drill size.

All hole positions indexed radially around jet axis. Turret is double tooled.

Former Method: Production—58 pieces per hour, standard, on a 3 spindle gang drill. Fixture was progressively moved from one spindle to the next on 8' table.

Burgmaster: Production—88 pieces per hour, standard, with actual production running 130% over standard. Operator fatigue greatly reduced. All holes now drilled from one operator position on a stationary rotating fixture. Floor area requirements per machine reduced 50%. Based on savings alone this machine paid for itself in less than 5 weeks!

Paid for itself out of savings in less than 5 weeks!

THE BURGMASTER TURRET DRILLING MACHINE speeds all second operations—*center drills, drills, reams, taps, spot-faces, countersinks,* and *counterbores!*

SELF-INDEXING—Turret instantly power-indexes to successive station after each individual operation is completed!

6 STATIONS—Only one live spindle! Each spindle operates at its own predetermined speed. Two complete ranges cover 350 to 6200 rpm.

¼" CAPACITY IN STEEL—Larger hole sizes in softer materials.

For *more* parts per hour, for *lower* costs, put your second operations on a BENCH MODEL BURGMASTER TURRET DRILLING MACHINE! Here's a tool that not only produces more parts faster...it costs *far less* than conventional equipment often used for the same job! Write for circulars and specifications!

Want to see the Burgmaster in action? We'll arrange a free demonstration in your plant upon request!

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AIRCRAFT and MISSILES... TRENDS

Military electronics boom...

The Defense Dept will spend about $4 billion this year on military electronic procurement, Deputy Defense Secretary Quarles revealed in a speech last month.

This is the Pentagon's first official estimate of the total sums now being earmarked for electronic gear in aircraft, missiles, and other weapon systems—as well as for so-called "pure" electronics such as ground radar, communications, and the like.

The $4-billion chunk for electronics comes out of a total figure of slightly over $14 billion for all military hardware.

The electronic share of the military aircraft dollar has grown from about 18% in 1955 to about 25% now, is expected to rise to as high as 40% of the total over the next two or three years. Meantime, airframe costs are now down to about 50% of the total military aircraft dollar and the proportionate share is dropping steadily.

For missiles, the airframe-electronic ratio remains fairly stable with a split of an average 20% airframe and 35% electronics.

The percentages for electronics vary greatly, of course, among individual planes and missiles. The proportionate amount of electronics in a fighter-interceptor plane and an air-to-air missile, for instance, is overwhelmingly greater than in a long-range bomber or in a long-range ballistic missile that is complete with all-inertial guidance.

Role of electronic industry...

All these figures point up the electronic industry's increasing diversification into electronics work by airframe, automotive, and other metalworking companies.

Against this backdrop, the old-line airframe producers and electronic makers continue their fierce competition for weapon system prime contracts on the Space-Age weapon systems.

Future trends...

Electronic producers now figure prominently as missile prime contractors. Ramo-Wooldridge acts as system engineer and technical director over the Air Force's three ballistic missile projects. In smaller tactical or air defense missiles, in which the airframe rates as a much less critical item than the electronic guidance, electronic companies are rating more and more as prime contractors.

Underscoring this trend, Air Force Under Secretary MacIntyre recently said: "As progress is made in the space era, industries now considered as secondary sources of air-power hardware may become the primary manufacturers.

"In other words, industries now specializing in electronics and propulsion may become our prime contractors.

"This is not a prediction; it is simply a recognition of the fact that evolutionary processes are at work in industry as well as in military technology."

AF "not hidebound"...

MacIntyre's reference is to Ramo-Wooldridge's role in the Ballistic Missile Program. Along the same lines, an Air Force procurement policymaker tells *American Machinist:*

"The Air Force isn't going to be hidebound to airframe makers when we contract for future weapon systems. As you get into more advanced systems, all you need is a tin can to put the bombing system, navigation, fire control, and such—all electronic stuff—together."

This official—a Colonel with an electronic background—goes even further. He says he'd personally like to see the "established electronic companies" getting control over production of more advanced weapons, because the aircraft companies "have only limited electronic capabilities." His point is that there's just not enough technical talent to go around.

On Space Age weapons, he's not sure the electronic companies are necessarily interested in producing the airframes or hulls, and they could go to the old-line aircraft manufacturers "for a piece of sheet metal" to put the electronic gadgetry and rocket together. On this score, note that the Air Force's policy is to spread as much business as possible among subcontractors. The unofficial target is a minimum of 40% of total costs.

"Vets" or new blood?

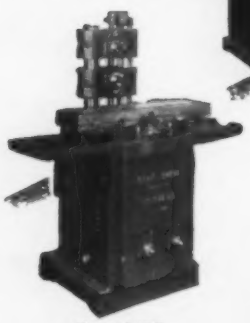
The Air Force Colonel quoted here is electronically-oriented. He doesn't necessarily reflect the Service's definitive policy at all. There's still considerable sentiment for sticking to the "veteran suppliers"—that is, the old-line airframe makers—for management of the new weapon systems. But the Colonel's views do demonstrate the kind of official thinking that does exist, and which is being increasingly reflected in Pentagon policy.

EXTRA RUGGED... SPEEDY... ACCURATE...

to Bring Down Milling Costs!

No. 1-14
32" x 9" table ... 14" table travel ... hydraulic table feed ... full automatic cycle.

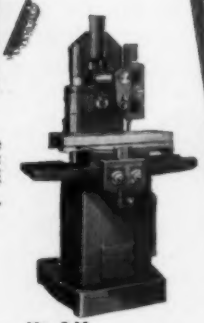
No. 2-20
20" table travel... 42" x 12" table.. fully automatic hydraulic table feed.



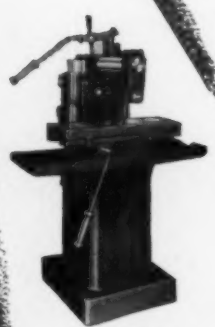
No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.

No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel ... 42" x 12" table.

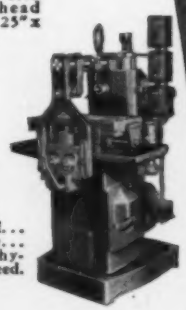
No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.



No. 1-V
Hydraulic vertical head feed ... 5½" head travel ... 25" x 9" table.



No. 1-M
Hand feed to table and head ...25" x 9" table ... Adjustable head counterbalance.



No. 1-8
8" table travel... 25" x 9" table... automatic hydraulic table feed.

STEP UP SPEED and ACCURACY!

Put the work on Kent-Owens Machines for top-speed milling and topmost accuracy to keep your costs at a minimum! Advanced features throughout these rugged machines make the difference . . . greater dependability . . . accuracy maintained in meeting tough production schedules. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to spindle. Write for bulletin #754 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, O.

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MACHINE TOOLS...

Russia's new developments...

Further evidence of almost startling advances in types and quantities of machines produced in Soviet Russia has come from a recent visit to Russian machine tool building plants by Robert V Asquith, chairman of England's Asquith Machine Tool Corp Ltd.

Radial drills of 35-mm, 50-mm and 75-mm capacities are being made on a conveyor line for drill heads and final assembly, moving automatically when the cycle requires it, Mr Asquith disclosed. Heads for the machines are put through in different batches at a rate of about one every hour on a 24-hr basis. Final assembly is geared to this rate.

Mr Asquith said that larger radials of 100-mm capacity and up to 14-ft radius are being built in a plant capable of producing at least 20 a month.

At a boring machine works in Lenigrad, a machine of about the same capacity as an Asquith 5⅛-in. machine takes five to six weeks to be made—from receipt of casting to final inspection.

One Soviet factory now is capable of building at least 21 major in-line transfer machines a year, Mr Asquith revealed.

In addition to the types of machines mentioned, Mr Asquith saw in production in Russia copying lathes, presses, multi-spindle automatics and floor and table-type boring machines. He said that the superficial finish of Russian machines is not quite up to the standard of British machines, but there is little doubt that the Russian machines are workmanlike and will do the job for which they are produced.

Schools to get surplus tools...

At least 60,000 machine tools are needed by technical schools and colleges if an adequate training job is to be done, the Metalworking Equipment Division of the Business and Defense Services Administration finds.

Reports from less than a dozen States reveal that educational institutions within those states could readily use 20,000 machines. These facts give support to the campaign for donating surplus government machine tools to schools.

Whenever machines become surplus and all-federal agencies have had a chance to acquire them, the unasked for tools are to be made available to schools. Each State governor has designated a surplus officer who is in charge of allocating tools to schools that have requested them.

It is estimated that around 800 government surplus machines have found their way into school the past year.

BDSA thinks that some tools may be available for schools from Ford's Chicago plant in July, when some 2000 machines will be tagged surplus. Lending of tools to schools for the National Industrial Reserve is being seriously considered. The point is that the armed services may not have enough money to maintain them merely in standby condition. If the machines were on loan to schools, they would be in use and there would be no maintenance expense to the armed services.

If you buy a machine...

If you buy a new machine tool now, you can get prompt delivery, you have assurance that the builder is not working with the pressure of delivery and the machine will be carefully made, you have more time to find out what machines suit your requirements best, and you will be taking the first step in a cost-reduction program. Thus Jerome A Raterman, president Monarch Machine Tool Co, advised in speaking to local bankers and machine tool customers at the recent show sponsored by George M Meriwether Inc, Birmingham, Ala.

Three years after you buy a new machine, Mr Raterman said, you will find that your actual cash outlay will be no more than if you had given your old machine a factory overhaul.

Your cash return through depreciation probably will be more on your replacement purchase than it would have been on the factory overhauled job.

Monarch will accept orders with a down payment of 25%, Mr Raterman said. The customer can take his choice of paying the balance over 12, 24 or 36 months in equal payments. The charge is 6% simple interest—one-half of one percent a month on the new declining balance. Monarch retains title to the machine until the final note is paid.

A number of other machine tool builders offer machines on the same basis as Monarch, with perhaps slight variations.

BF

Here it is!

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"Grade Mark Service" for alloy steels . . .

gives you fast, accurate identification of stock!

"Grade Mark Service" is a bonus to alloy steel buyers. It means faster identification, speedier handling and better stock control of alloy steels purchased from U. S. Steel Supply.

Every alloy steel order shipped will have a seal which clearly identifies the grade of that particular bundle, thereby making it easier for your receiving department to check and stock incoming shipments. We believe it is especially important that high-grade steel be quality-controlled—all the way.

These bundles are steel-strapped, too—firmly and securely bound with USS Gerrard* Steel Strapping.

This adds up to: **1. Instant and positive identification of material on your receiving floor. 2. Safe and easy-to-handle bundles.**

Technical Data

A test report and a heat-treatment guide are mailed to you with each lot of alloy steel you purchase. The test report gives you the actual chemistry, mechanical properties, or the hardenability together with the guaranteed minimum hardenability. The heat-treatment guide gives the recommended heat-treating and working temperatures.

Our "Grade Mark Service" for alloy steels includes: USS* Carilloy alloy steels —hot-rolled rounds, cold-finished rounds, squares, hexagons, "FC" (Free-Cutting) rounds; USS Carilloy* Aircraft Quality hot-rolled rounds and flats and cold-finished rounds, squares, hexagons, flats.

Here is an improved method of bundling and marking shipments of alloy steels. Why not see how you can benefit from "Grade Mark Service"? Call your local U. S. Steel Supply warehouse the next time you need alloy steel.

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MATERIALS... TRENDS

Bearing steel: 1000 hr at 1000 F?

Secondary hardening seems to be the key to finding a bearing steel which will meet the target value set by Wright Air Development Center—R_c 58 after 1000 hr of heating at 1000F. Now in its third year, the development program is centered by the comparatively new findings regarding precipitation hardening.

Quenched high-speed steel contains as much as 25% retained austenite. For many years it was thought that secondary hardening resulted from the transformation of this retained austenite to martensite. Instead, it now is known that secondary hardening results from a precipitation reaction which takes place in the martensite during heating at 800 to 1100F.

Precipitation hardening is done in a two-stage heat treatment. For high-speed steels, the precipitant is finely divided and distributed particles of tungsten, molybdenum, and vanadium—which cause hardening by "locking" the grain boundaries and slip planes within the alloy crystal structure.

A E Nehrenberg, Manager of Technical Development at Crucible Steel, reports that developments in high temperature steels are nearing the target requirement; especially in resistance to tempering. But corrosion resistance is poor. The third-year program is investigating Type 440C stainless with the hope that it can be modified to provide good corrosion resistance plus adequate hardness on tempering at 1000F.

A fork in the road...

Metallurgical strength, and hardenability, has reached a point in technology where many people are wondering which way to go. Two main roads are open. Other roads are seen in the distance. Strength can be achieved in two ways—by absolute purity of metal and by adding impurities. The latter, using precipitation hardening, provides strength but forfeits ductility; makes working the harder alloys almost impossible. And it looks now as if this method cannot offer much more than 400,000 to 500,000 psi yield strength.

Absolute purity, on the other hand, is not easily come by. New refining techniques and equipment must be developed. But this method offers much less limited strength *with* ductility. The pure iron "whiskers" produced at General Electric were *soft* yet the yield strength was 2-million psi. Some researchers are returning to the crossroads—to follow the high-purity path.

Vacuum melting and casting, especially the technique of double melting (using vacuum induction melting to produce a consumable electrode which, in turn, is vacuum melted to form a billet) are major contributions to purity. "Zone melting," developed by Pfann of Bell Laboratories to produce pure metallic crystals for transistors, may be applied with much larger equipment than at present—to supply these super-strong metals.

Plenty of nickel...

Free world nickel production capacity in 1958, it is estimated, will total about 525 million pounds—115 million pounds more than the free world used during 1957. Free-world production capacity is expected to reach 650 million pounds by 1961. This is about 50% more than the total free-world consumption for both civilian and defense purposes in 1957. Supplies of nickel, according to The International Nickel Company, are more than ample to fill every demand.

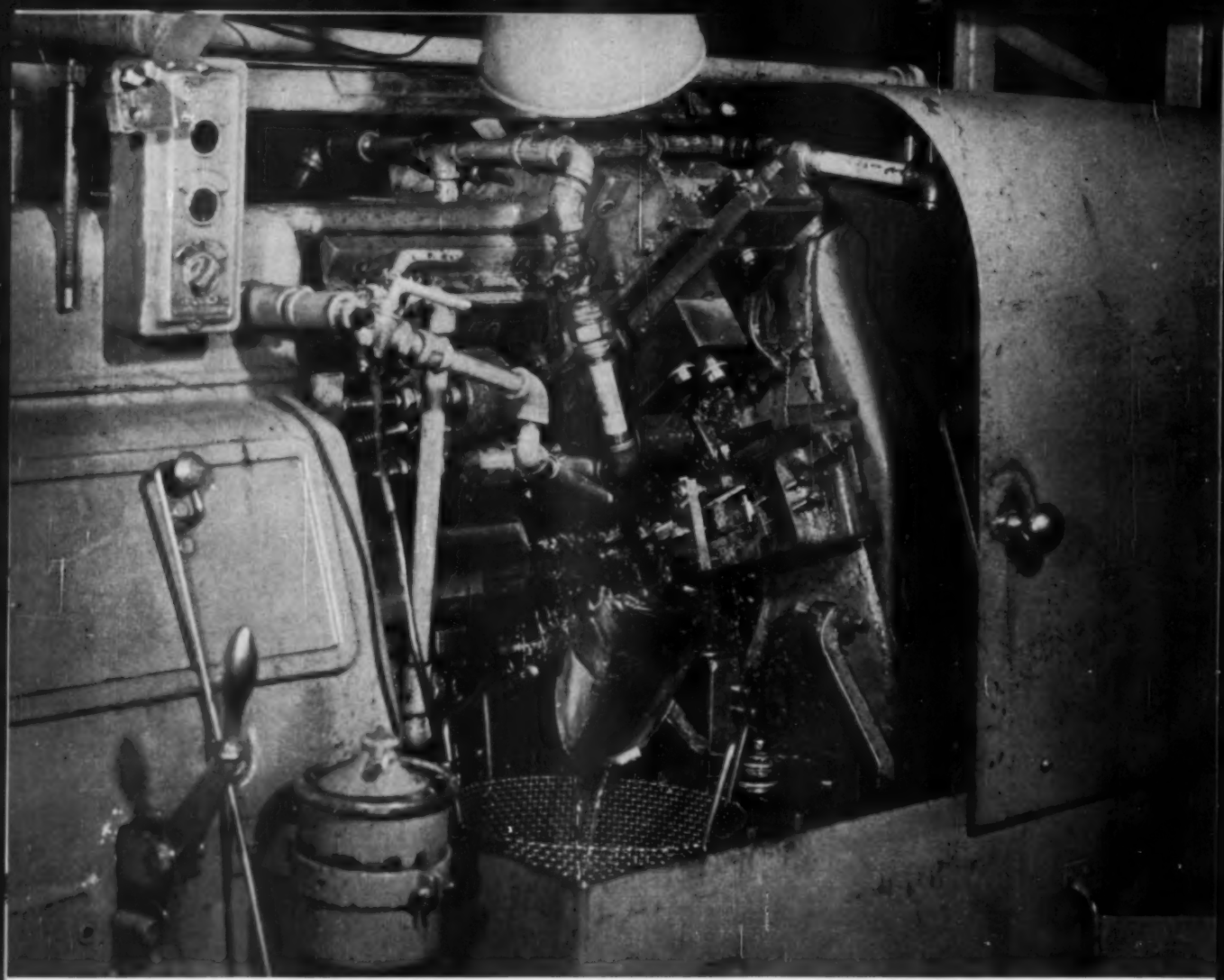
More aluminum-coated steel...

Commercial production of aluminum-coated sheet steel will follow a facility modification program at U S Steel's Irvin Works near Dravosburg, Pa. The company now is altering the 48-in. lightgage, continuous-hot-dip, galvanizing line to also produce aluminum-coated steel sheets. Market for this material is expected to include kitchen range components, laundry units, space heater reflectors and parts, furnace parts, automotive mufflers, and roofing and siding. Ease of applying porcelain to aluminum will simplify finishing appliances.

Foamed silica...

Foamsil, a new material produced by boiling and foaming silica in a specially designed continuous horizontal electric furnace, can neither oxidize nor absorb water. It is unaffected by all acids except hydrofluoric and hot phosphoric. A 1-in. thickness provides equivalent insulation to an 18-in. thickness of acid brick at 250 F.

- For depositing molybdenum on other metals, new chemical processes offer many favorable properties, according to Dr H W Scultze of Climax Molybdenum in a talk highlighting two promising deposition processes—hydrogen reduction of molybdenum pentachloride and thermal decomposition of molybdenum hexacarbonyl. Vapor-deposited coatings provide corrosion-resistance, wear-resistance, and high speeds at elevated temperatures.



Here's how Transultex reduces automatic screw machining costs

Texaco Transultex Cutting Oil reduces the frictional heat at the chip-tool interface. This prevents chip welding, lengthens tool life and lowers power consumption.

Transultex is transparent, and stays that way in your machines. Inspection is easier. Machined surfaces stay clean, come out with a better finish. Which means fewer rejects, more production.

Texaco Transultex Cutting Oils are part of the complete line of Texaco Cutting, Grinding and Soluble Oils, all designed to help you increase production and lower costs. Simply call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking is holding to spring levels . . .

Traditionally, metalworking and industry in general can be expected to experience a letdown as summer comes on. But this year so far the summer dip hasn't shown signs of materializing.

Perhaps it's because industry has "already taken its licking" and there is no place to go but up.

In any event, metalworking has shown no signs of dropping off from late spring levels, and it is running well ahead of the dark days of last December and the first quarter of this year.

But history has shown that there is little chance of a large-scale comeback during traditionally slow summer months. Thus most metalworking executives expect that the industry will do well to hold its own through the hot weather, then gather steam during the fall and winter.

Automotive assemblies early this month hit the highest total since late March, but long shutdowns for model changeovers will begin to have their effect on production soon.

Appliances, too, have shown something of a pickup in sales and production, paced by TV sets.

McGraw-Hill's Index of New Orders for Machinery has some heartening news. As of last report, only two of the six machinery groups that make up the Index—"Other industrial machinery" and "engines and turbines" showed declines in new orders.

Metalworking machinery makers reported business up 2%. Office equipment manufacturers said business is holding steady, and the pump and compressor industry chalked up a whopping big increase of 26% in a single month. Construction and mining machinery showed a healthy seasonal increase of 13% in new orders.

New contracts for industrial construction were on the increase, too, for the first time since last January.

Long-awaited government orders for aircraft and missiles are beginning to come through. But the switchover from emphasis on manned aircraft to guided missiles is already becoming apparent.

An example: Lockheed is steadily decreasing employment at its California and Georgia Divisions (mostly manned aircraft) and increasing employment in its Missiles Systems Division.

Stamping industry is now anticipating a summer "stronger than we had thought a couple of months ago"—mainly for electronics and TV.

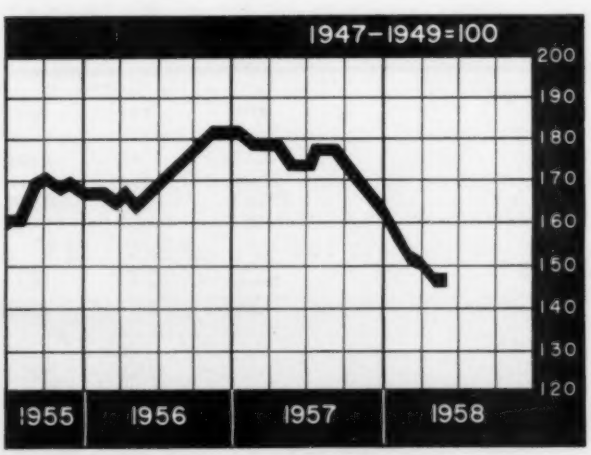
Some strength is being shown in other appliance orders, too. And despite "pretty dead" demand for automotive stampings, the industry expects 1958 to wind up as good as 1957.

Steel production is the big question mark just now. What with a steel price rise of $5-$6 a ton still up in the air, it remains to be seen whether the recent upsurge in steel buying was by firms running scared in the face of an expected price boost—or whether it reflects improving output.

Steel warehousers in June noted a continuing pickup in small orders designed just to keep plants operating. This may be an indication that a steel buying letdown is just ahead.

Especially good news is contained in latest figures from the Commerce Dept, which shows that manufacturers' sales were up $200 million in May from April levels, with durable goods sparking the rise.

At the same time, inventories of durable goods producers dropped $400 million—a health sign.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

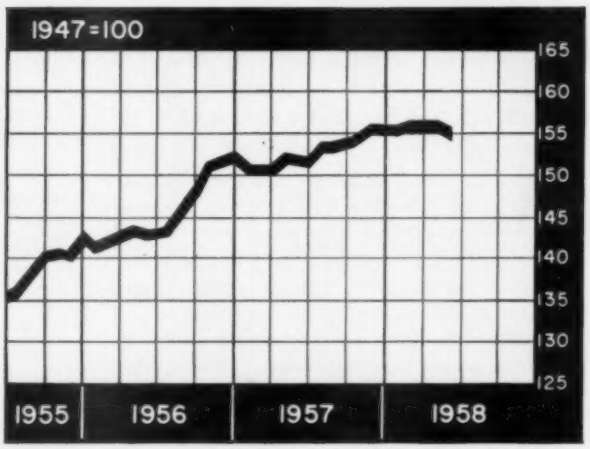
	JUNE Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**148**	**148**	**146**	**175**
Machinery	122	123	152	
Electrical Machinery	169	166	199	
Autos	90	86	127	
Other Transportation	346	336	371	
Other Metalworking	128	128	142	

TRENDS WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**155.8**	**155.9**	**155.9**	**151.9**
Metalworking Machinery	**182.3**	**182.3**		**176.9**
Other Machinery exc. Electrical	**165.8**	**166.1**		**160.6**
Electrical Machinery	**158.1**	**158.0**		**154.3**
Fabricated Metal Products	**146.4**	**146.4**		**143.3**

155.8



High unemployment even during recovery?

Unemployment again bolted over the 5-million mark in June as students and graduates poured into the labor market at the close of the school year. A May-June rise in the number of jobless is normal. But there are indications that even as recovery proceeds, unemployment will remain at a high level. Here's why:

In the initial stages of recovery, much of the pickup in production can be taken care of by lengthening the hours of already employed workers rather than by tapping the supply of jobless. In the previous recession, for example, manufacturing production began climbing in July 1954 and had increased about 6% by the end of the year.

Factory employment, however, rose only 2% —or a third the gain in production.

Steady expansion in the length of the work week—from 39.4 hours in July to 40.5 hours in December—was a major reason why production gains outstripped the employment improvement.

Productivity rises also will absorb some of the increases in output. Productivity in the nonagricultural sector of the economy has been increasing at an average rate of 2.5% a year in the past decade. And in periods of recovery such as we are now entering—when the amount of capacity in use rises toward more efficient levels—productivity improves at rates well above the long-term average.

Growth in the size of the workforce is also working against a sizable shrinkage in unemployment. The civilian labor force should increase by 400,000 in the next six months.

What these points add up to is this: Unless recovery is a lot more vigorous than is now expected, unemployment will not sink below 4.5 million at any time in 1958.

QUARTERLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	132.9	133.6	147.8
Steel ingot operations (thousands of tons)	1,423	1,666	2,009
Electric power output (million Kilowatt hours)	11,757	11,941	12,111
Production of automobiles and trucks	118,105	110,538	160,386
Engineering construction awards (Eng. News-Record—millions)	$466.3	$483.1	$483.6

MONTHLY BUSINESS INDICATORS

	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	$422.0	$432.6	$429.9
Expenditures of new plant and equipment (millions)	$31.36	$32.41	$37.03
Profits after taxes in primary iron and steel industry (millions)	$159	$267	$390
Profits after taxes electrical machinery industry (millions)	$162	$221	$236
Profits after taxes in motor vehicles and parts industry (millions)	$213	$346	$467
Profits after taxes machinery (except electrical) (millions)	$190	$253	$385
Motors and generators new orders index (1947-1949=100)	150.0	174.0	203.0

* Seasonally adjusted

You asked for it . . .

AND HERE IT IS . . .

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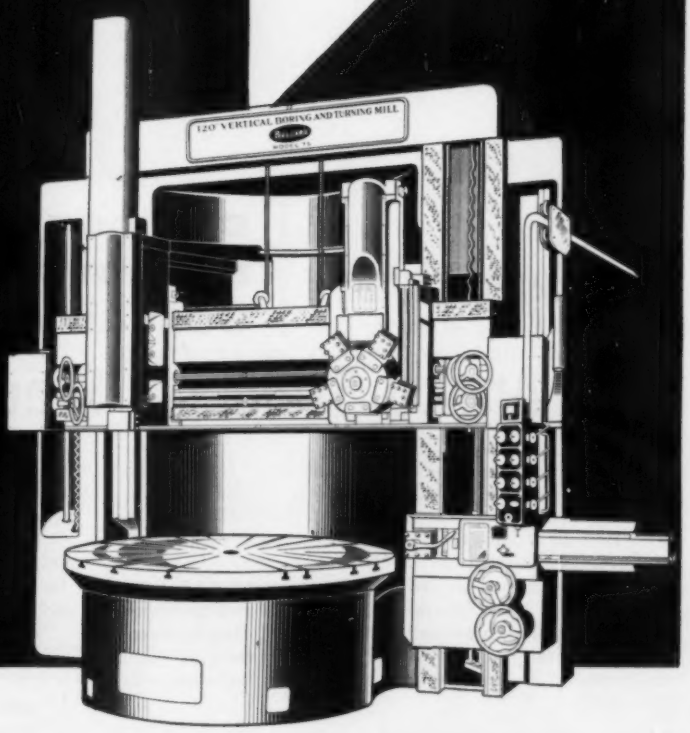
BULLARD 120"

VERTICAL BORING AND TURNING MILL

SWINGS 120" — TABLE SIZE 108"

Recognized for over seventy-five years as the leading builder of vertical turret lathes and boring mills, The Bullard Company has been repeatedly asked to build mills of a larger size incorporating the features of the Model 75 line.

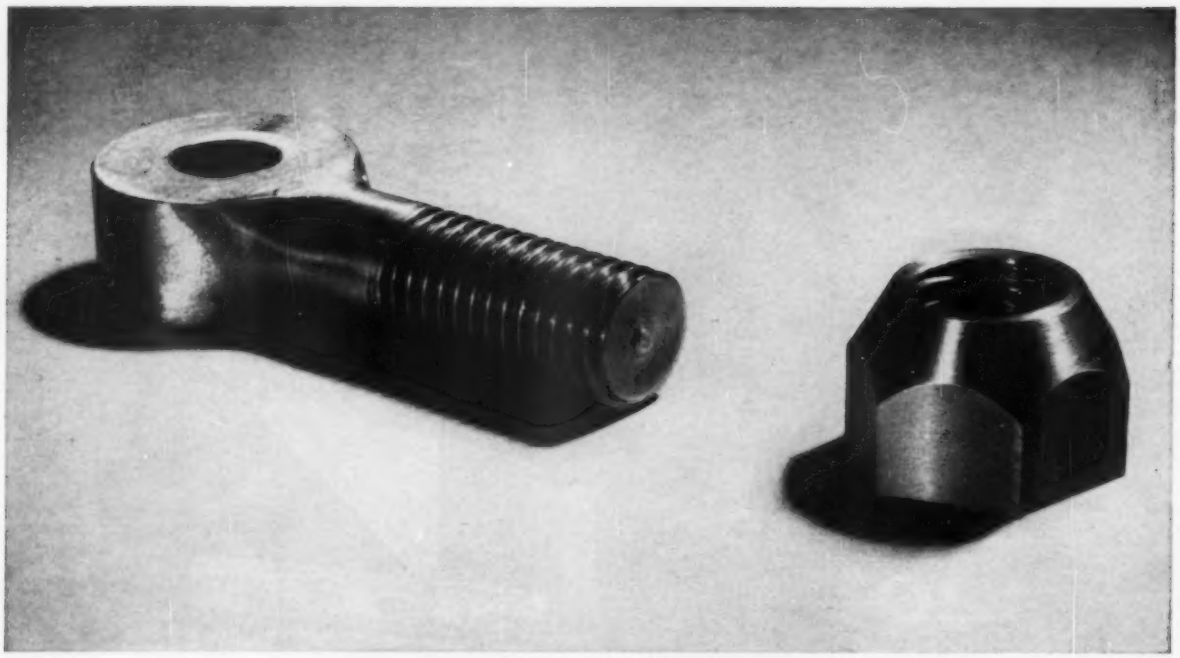


The Bullard 120 Vertical Boring and Turning Mill is designed, engineered and built to meet this customer demand. Feature for feature — by comparison — you'll find it is the outstanding mill on the market today.

BULLARD

REMEMBER . . . to cut costs when cutting metal — Buy BULLARD

THE BULLARD COMPANY
BRIDGEPORT 98, CONNECTICUT



How Manufacturer

CUT COSTS
IMPROVED MACHINABILITY
SOLVED HARDNESS PROBLEM

With Armco Stainless Steel

A producer of commercial laundry machinery was making this locking nut of Type 303 stainless. No corrosion or machining problems were encountered but this grade of stainless wasn't hard enough to meet the company's standards for durability in service.

Armco was asked for help. After analyzing all the requirements of the part, Armco engineers recommended Armco Type 416 Stainless. This grade of Armco Free-Machining Stainless not only solved the hardness problem but provided better machinability and cut material costs appreciably.

Cut Your Costs with Armco Stainless and Armco Services

Whether you are encountering any problems or not, Armco may be able to help you cut costs of parts that must resist corrosion. That's because Armco produces over 60 standard and special grades of stainless including 12 free-machining varieties. You can select the grade that exactly meets your requirements at least cost. And Armco engineers with years of experience are available to assist you in selecting the proper grade.

Other Armco Services can save you money, too. Machining experts with practical shop experience will consult with you on how to cut machining costs and step up production. A new Armco movie, "Machining Stainless Steel," will give set-up men, operators and tool designers many helpful suggestions. And a practical reference booklet on machining stainless is yours for the asking.

Take advantage of the cost-cutting opportunities you can get with Armco Stainless Steel and Armco Services. See for yourself how they can help you boost profits and product quality.

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American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

A Hearty Endorsement

The skeptics are busy chanting a chorus of pessimism about the future. They have no faith in the immediate outlook and are even viewing the 1960's with disenchantment.

This defeatism is hardly in keeping with any reasonable assumptions about our future course, if past experience has any meaning at all. It is at variance with findings of responsible agencies.

Hours of work have declined steadily through the years. From 1930 to 1950, they went down about 3 hours per decade. Productivity gained, on the average, about 2½% annually from 1930 to 1957. It was higher than that the first 10 years after World War II, but lower the past two years.

The constant rise in productivity, despite a shorter work-week, has made it possible for the gross national product to grow and for the worker's dollar income to buy much more in goods and services than it used to (twice as much now as in 1919, to be specific).

Our economy produces today . . .

five times as much in an hour as it did 75 years ago, the Committee for Economic Development points out.

The figures from the past, mind you, include periods of rapid population growth. They also include periods during which population rose so little that the experts forecast a decline, a prediction in the late 1940's that proved abysmally wrong.

We now are taking a breather after a long, steep climb. The breather is causing a lot of anxiety. The cautious and the timid are ready to read gloom into every new set of facts or circumstances.

Suppose we look ahead. What's there?

Well, we could do a series of stupid things that would stultify our future growth. There could be a nuclear war. We could adopt policies sapping the ambition of individuals to work, save and invest, and removing the incentives of business and industry to expand.

Odds are, however, that this will not be the case. Our record-breaking outlays for research and development are testimony to our unprecedented interest in the future. The fact is that our future growth patterns bid fair to resemble closely those of the past. There will be downs as well as ups, but over any considerable period of time, the trend will continue to be up.

Just one prediction . . .

If the labor force increases as expected (a dependable forecast, since most of the people who will make up the labor force in 1975 are already born), and if output per manhour increases 2½% per year (a reasonable assumption), gross national product will grow from $434 billion in 1957 to $581 billion in 1965 to $835 billion in 1975, figured in 1957 prices. It is hardly necessary to point out the stimulating effect of such growth in the GNP on the entire economy.

We have faith in our national future. We do not go along with the skeptics. We heartily endorse the conclusions of the research and policy committee of the Committee for Economic Development which states the case better than we can:

"The revelations already afforded . . .

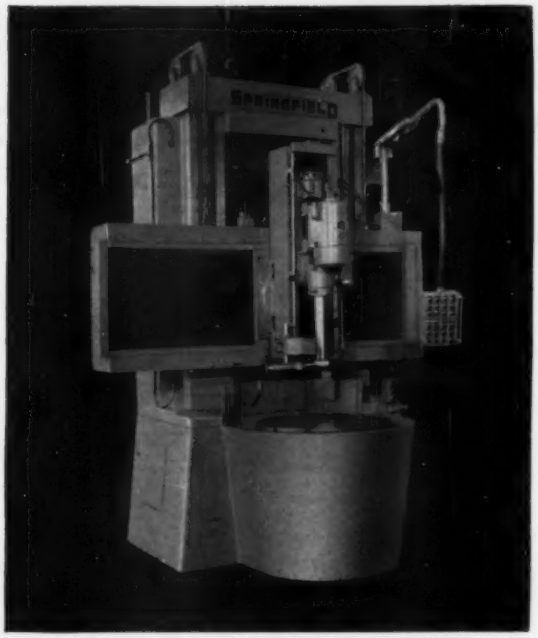
by statistical knowledge disclose, unmistakably, a long trend of growth continues to operate; that trend can reasonably be expected to continue.

"A momentous conclusion follows: that if we conduct our economic affairs with intelligence, we can reach a general level of material well-being higher than was ever before conceived of as possible."

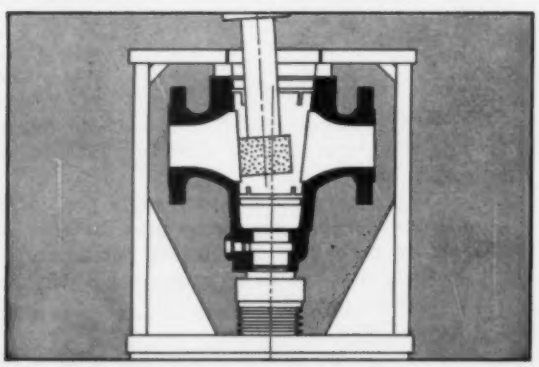
Burnham Finney EDITOR

Vertical grinding tapers profitably

SPRINGFIELD



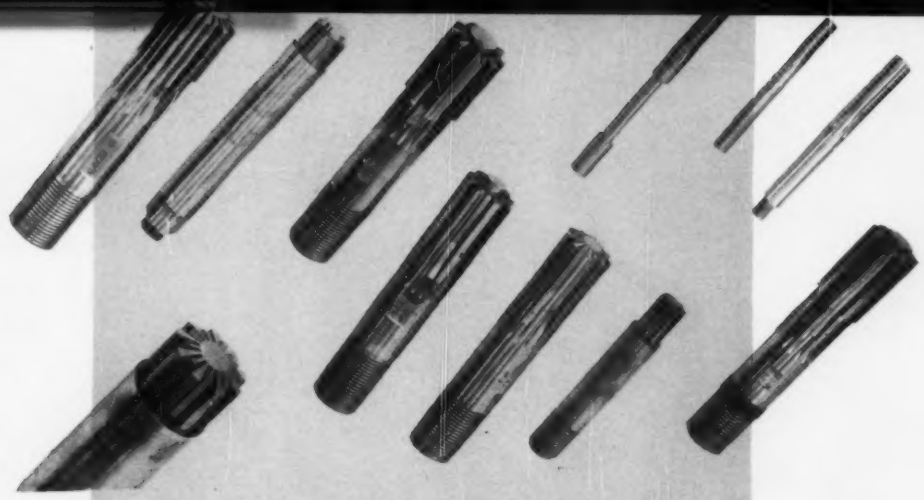
Standard vertical grinder above is typical of those used by leading manufacturers of large valves for grinding internal taper seats. Profits are made because set up time is fast; for example, it takes about five minutes to change over from grinding 18″ valves to 10″ valves. The inherent rigidity of the machine is made doubly effective by gravity. Valve, fixture, and face plate are supported on a heavy *vertical* work spindle which promotes accuracy, precise concentricity, and extremely fine micro-inch finish.



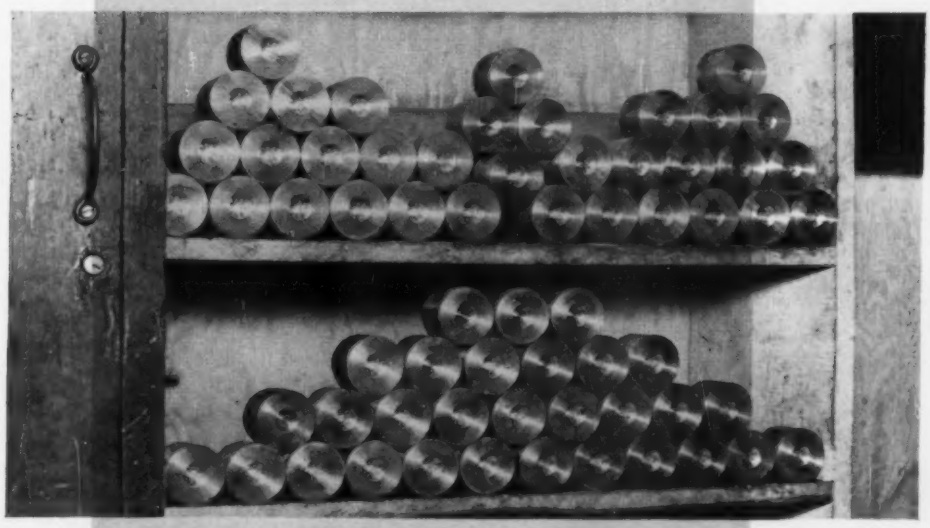
Internal valve tapers, as shown above, are fast payoff jobs on a Springfield Vertical Universal Grinder. On this valve taper, stock removal is 0.020″ with a requirement for 85% blue or better on a taper gage. Surface finish is held well within the 30 RMS specified. Machine swings to 52″, grinding holes from 2″ to 42″ dia., 24″ deep in irregular or regular shaped work pieces.

Not limited to internal or exterior tapers, a Springfield grinds efficiently on O.D. and I.D. shoulders, offsets, undercuts, irregular holes, and mating angles—usually in one chucking.

A few production and toolroom men turn to a Springfield because there's no other way to do the job. Most turn to a Springfield because it's the most profitable way to do many jobs. Write today for Bulletin No. 197-D. The Springfield Machine Tool Company, Springfield, O.



Extrusion punches like this...



Produce microwave cavities like this as...

Extrusion cuts time from 3½ to 1.5 min

Fifteen years of development work at Raytheon have gone into perfecting the cold extrusion process. Here at last are the details on the tooling that makes intricate cavities in a fast production process

ANDERSON ASHBURN,
managing editor

Intricate shapes are produced in a single operation by cold extrusion at Raytheon. Complete cycle time to produce a cavity runs about 1.5 min, compared with a time to machine the cavities that would be totally impractical for quantity production.

Developed by engineers of the Microwave and Power Tube Div of Raytheon Manufacturing Co in Waltham, Mass, the process (called hobbing by most of the electronics industry) is applied in the production of microwave cavities in the Power Tube Plant.

Basically, however, the process is a highly refined and precision form of cold extrusion offering some valuable lessons in tooling.

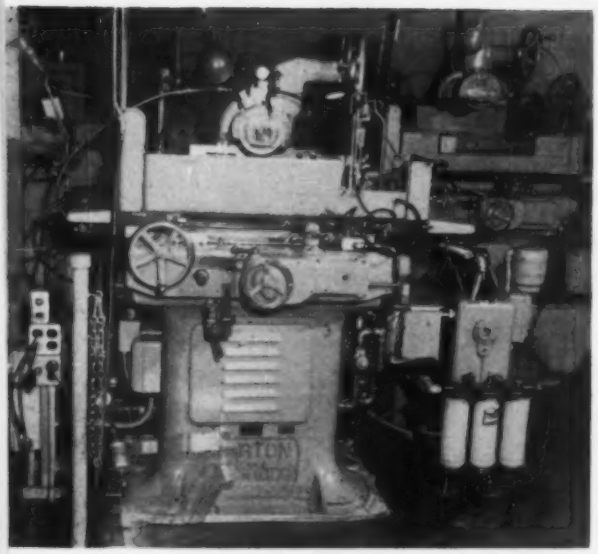
Pitfalls lie in every stage of the process, and it has taken 15 years to develop the right combination of steel for the hobbing tool (punch), grinding equipment, blank preparation, and press tooling to reduce the operation to something approaching a routine.

The technique need not be limited either to copper or to magnetron bases. At Raytheon, for instance, they are already experimenting with aluminum gyro cases and other applications are expected.

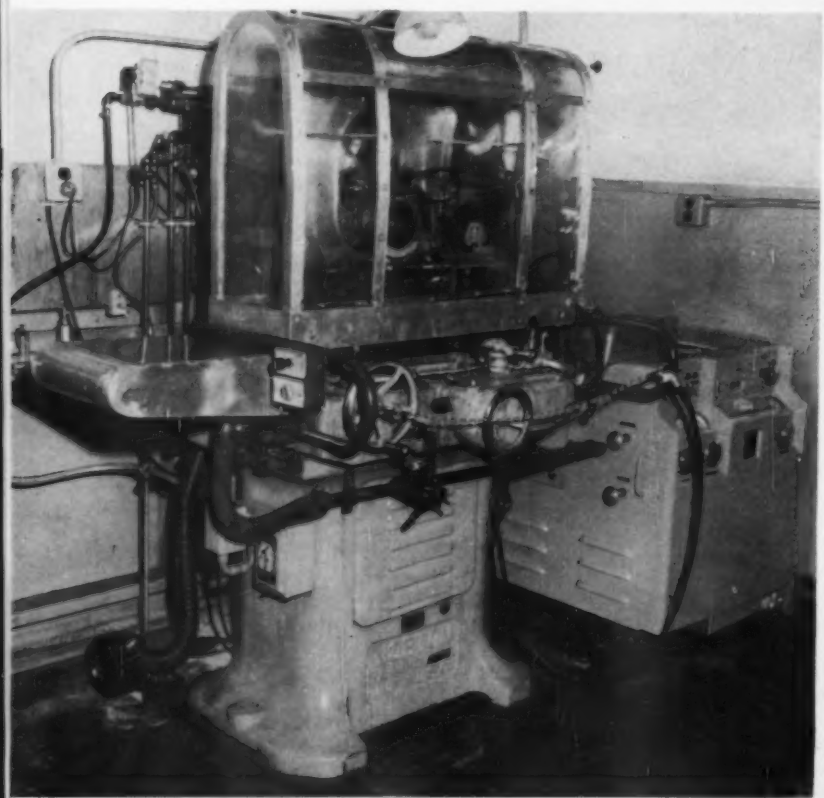
STEPS IN MAKING A HOB

Not all hobs are made of the same steel, but the most common one tried as a starting point is a composition of 0.70 C, 2.0 Mn, 0.30 Si, 1.5 Cr, 1.5 Mo.

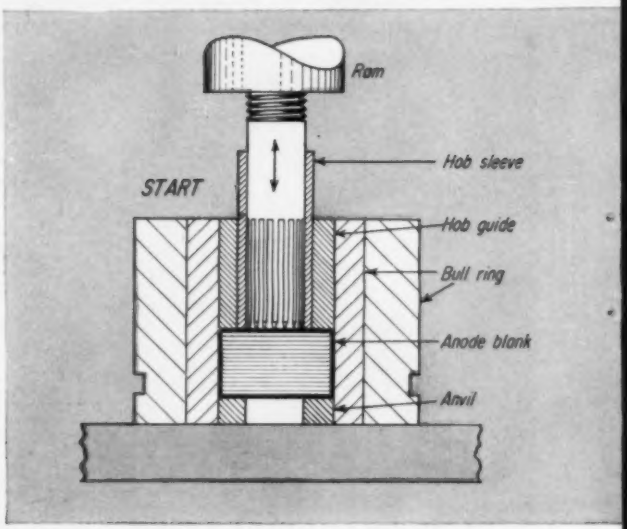
First step is to turn the blank and establish centers. After Magnaflux and an ultrasonic inspection, the



Early grinder adaptation . . .
hung the auxiliary equipment in all directions as additional requirements were discovered. The Norton 6 x 18 surface grinder is the basis, with both heater and cooler added to the coolant system, both magnetic and filter coolant cleaning, a special fixture and indicators, interlocks and controls



Latest grinder is more sophisticated . . .
version with the same characteristics. All additional controls have been consolidated in the cabinet at right and housing has been improved to provide cleaner atmosphere around the work. All plastic canopy has replaced plastic and metal combination of an intermediate model. Weight has been removed from the traverse ways and is supported through tubular frame from the base



Extrusion cuts time, continued . . .

blank is hardened and double tempered to 58 to 60 R_c. The drawing operation is always performed at the lowest temperature recommended for the steel because of many subsequent stress-relieve treatments.

The blank is again magnafluxed and then rough ground on a cylindrical grinder. It is stress relieved, finish ground, stress relieved again, magnafluxed again and the centers are lapped. Then the hob is ready for the work of spline grinding.

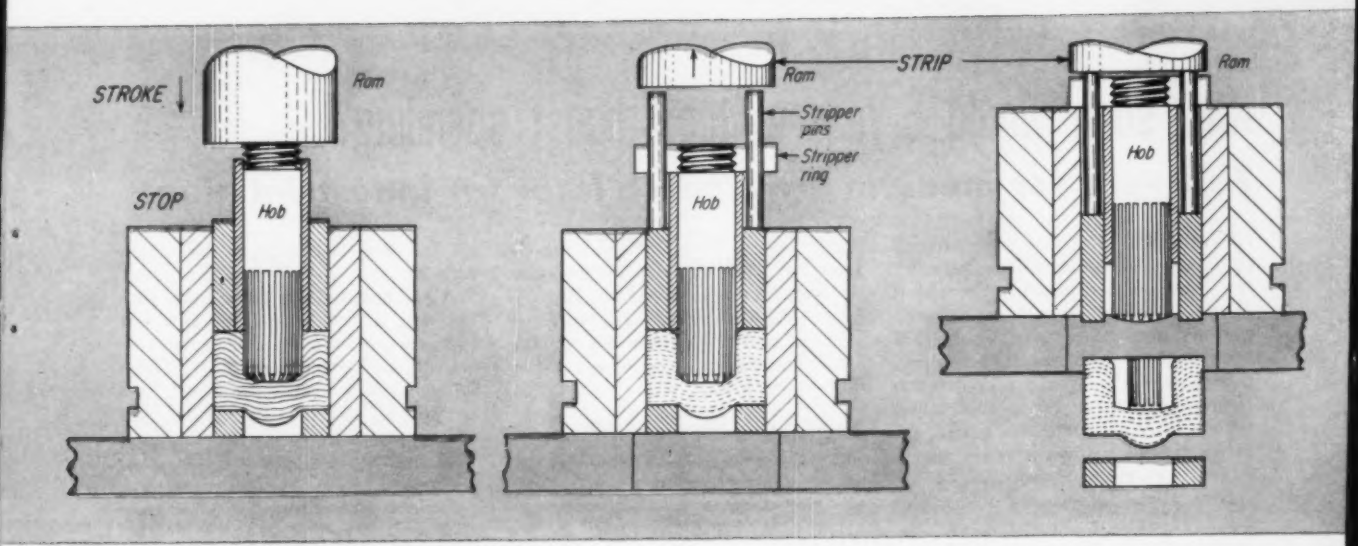
The hob is held between centers mounted in V-blocks and indexed by an electropneumatic index mechanism. Because the fixture must be "dead on" with the spindle, the V-blocks are mounted on the table and finish ground right on the machine.

The basic procedure for spline grinding consists of grinding 0.002 in. off the first slot, then indexing to the next slot position and making a similar cut. When the first cycle is complete, the wheel is advanced and a second cycle is made. As the slots are ground deeper the amount of feed is reduced. On deep and narrow slots the feed may be as small as 0.000,020 in.

This grinding procedure may take several days on a complex punch and depends on accurate positioning of the work and wheel through hundreds or thousands of grinds.

Grinders for this operation have all been made by modifying a Norton 6 x 18 surface grinder. The changes basically consisted of the addition of interlocks, heaters, coolers, filtration equipment, and an indexing mechanism.

Light grinding oil is used because it was found to carry off more heat per cc than water-based coolants.



Press tooling for extruding and stripping . . . is designed to give maximum protection to both blank and hob during the working stroke, yet allow for backward movement of metal over the punch

The oil reservoir in the base is equipped with both heater and cooler to maintain uniform oil temperature throughout the grinding cycle on a hob.

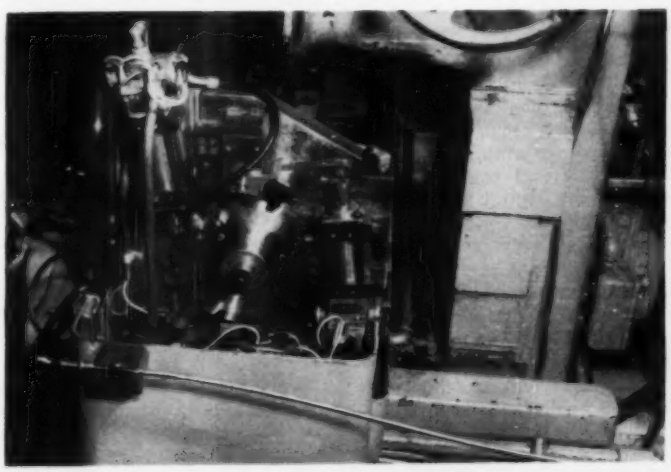
Filtration starts with a magnetic separator and then takes the oil through filter paper to eliminate all particles larger than 2 microns (about 0.000,070 in.).

Tenth indicators are mounted on the machine to check for creep in machine parts during operation. All of the controls and inspection devices are connected through interlocks with the control system to stop the grinding cycle if anything goes wrong. Indicators on the index mechanism are sensitive to 0.002 in. on the position of the plunger that locks the index plate. Any variation of temperature of the machine, creep of the table, or an excessive dwell of 0.1 sec will stop the machine.

Grinding wheels are dressed with twin diamond dressers ground to a fine point (75° included angle). In dressing, the wheels are checked with a small micrometer with carbide faces. It is necessary to compensate for the fact that the slot will be somewhat larger than the wheel. This compensation still depends entirely on the skill of the operator.

When slots must be ground with widths far below that for which wheels are available, the wheel is first thinned to size by impregnating with wax, holding on a vacuum chuck, and lapping down to size.

Pure, high-conductivity copper for the parts to be cold extruded is first upset with a volume displacement of 20 to 40%, then annealed at about 1200 F and finally cut into slugs and machined to size.



Index mechanism is electropneumatic . . . with air cylinders to provide rotation and locking and electric controls including an indicator on the locking pawl to insure accurate positioning of the index plate

Slugs are lubricated with wax or petroleum jelly in most cases, though some parts have been extruded without lubricant.

THE PRESS OPERATION

Both mechanical and hydraulic presses are used for the extrusion operation. Hydraulic presses are more common and sizes range from 100 to 1350 tons.

The hardened punch can only withstand compressive forces, so the tooling is designed both to answer this and to simplify the stripping of the work from the punch.

Within a bull ring on the press bed is placed first an anvil, then a blank, then a hob guide, and finally the punch (hob) in its own sleeve. As the press stroke forces the punch into the blank, the metal extrudes up around the punch, causing the hob guide to move up slightly.

For stripping, the stripper ring is attached to the hob and pins are inserted. On the next stroke of the ram the stripper ring rests on the bull ring and holds the hob while the stripper pins pass through the ring and push the hob guide down over the hob and sleeve, stripping the work from the punch. For this operation, the bull ring is positioned over an opening in the lower platen so the anvil and completed part can fall into the exit chute.

Punches are stress relieved from time to time after they have been placed in operation. For this purpose they are placed in a standard electric oven installed in the press shop.

How soon would 5-year writeoff boost spending?

This year for medium firms, much later for industrial giants

NEW YORK—If a five-year writeoff provision were to be written into U S tax laws on depreciation of capital goods, its effects would be immediate on new plant and equipment spending by the small-to-medium company, but it would take a much longer period for large companies, whose capital spending plans are often made for several years ahead, to revise spending upward.

That is the interpretation that can be read into a survey of capital spending plans of America's 500 biggest companies by Walter Kidde Constructors, New York and Houston engineering and building firm.

Based on 225 Companies

Of the 500 firms sent questionnaires, 225 responded. These 225 companies have combined 1958 capital budgets in excess of $5 billion representing something like one-sixth of the total estimated U S 1958 outlay for capital goods.

Of the 225 companies, 52 (combined 1958 budgets: $785 million) said that if five-year depreciation were to go through they would increase their 1958 outlay by $156 million. The other 173 responding firms (combined 1958 budgets: $4237 million) said five-year writeoff would have no effect on their '58 budgets.

On close inspection, it will be noted that the 52 companies who would increase their 1958 outlay under five-year writeoff have an average 1958 outlay of roughly $15 million, whereas the 173 companies which have no plans to increase their spending this year even if the new law were to go through, have an average 1958 planned capital spending outlay of nearly $25 million.

Would Affect Small Firms Faster

Thus it can be interpreted that as companies decrease in size (at least in the large company bracket) the effect of five-year writeoffs on capital spending would be more immediate. This, of course, is because the giants of industry make plans for new plant and equipment spending as much as a decade or more ahead —and revising them upwards or downwards is a long, slow involved process.

Projecting the Kidde survey into 1959, 78 of the 225 responding companies (total '58 budgets: $980 million) would increase spending in 1959 by $188 millions if five-year writeoffs were to come in. But 147 firms (1958 capital budgets: $4042 million) said they would not increase 1959 spending because of more favorable writeoffs.

Small Firms More Flexible

Again, interpreting the 1959 responses, it is apparent that the smaller "big" companies (78 of them averaging $12.5 million outlay in '58) are the only ones whose plans would be flexible enough to take advantage of more favorable writeoffs even next year. The larger companies, on the other hand (147 averaging $27.5 million capital outlay in '58) still wouldn't be able to take advantage of the new writeoffs a year from now.

Also included in the Kidde survey was a question "If present tax laws remain, will you spend more or less on capital goods in 1959?" Some 94 companies with a combined 1958 budget of $1658 million said "the same"; 46 firms with a combined 1958 budget of $903 million said "more"; and 80 companies with a combined 1958 budget of $2258 million said "less."

Steel, Chemicals Interested

Greatest interest in the five-year writeoff, according to Kidde president Williams Collins, was expressed by the steel, chemical and capital goods industries.

Vacuum heat treating of exotic metals Solves missile problems

CRANSTON, R I—"Exotic" metals for missiles and the Space Age present difficult problems in respect to heat treatment. The operations involved require temperatures up to 3000 F now, may go much higher in the future. Degassing, annealing, precipitation hardening and brazing of these metals requires utmost cleanliness. Another requirement is faster cycles.

Two Methods

Time is of the essence if any amount of production is to be realized. Two methods have been in use. (1) Use of inert atmospheres in batch furnaces requiring long heating and cooling cycles. (2) Heating in a vacuum in a "hot wall" furnace, in which the heating chamber is refractory lined and the work is placed within an inner retort. Again a long cycle is involved.

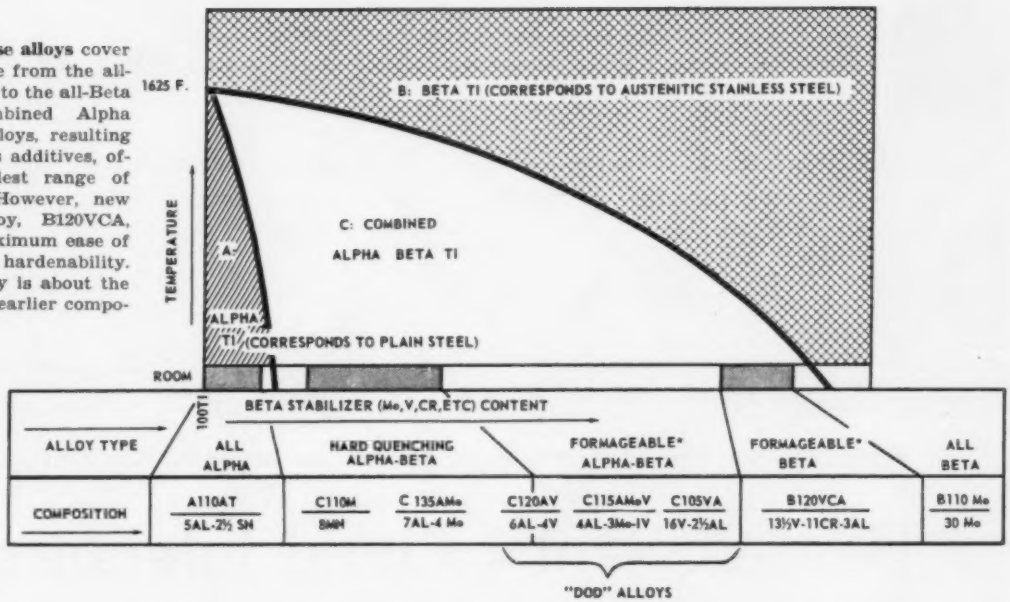
Resistance Heating Is Best

To get good control in a vacuum furnace, engineers prefer resistance heating, rather than use of inductance. But until recently it seemed that temperatures above 2200 F could not be realized. The answer to the problem is the cold-wall, resistance-type furnace with a heating chamber of heat-reflecting nickel-clad steel surrounded by a circulating-water jacket. Inside the chamber there is first a set of reflective baffles, then a new-type heating element and finally the charge in the center. C. I. Hayes, Inc., has had a production model furnace of this type operating for one year. Larger sizes are being developed. A furnace capable of taking a charge 2 x 2 x 3 ft is planned. The present furnace takes only 15 min. to reach full vacuum (0.1 micron). After treatment the work is raised to the cooling chamber above the baffled heating chamber, where the heat is rapidly radiated into the water jacket. Reduction of temperature—from 3000 F to 700 F—takes only 30 min.

New Fields Ahead

Examples of fields opened up by the new design of furnace are: proper annealing of titanium, brazing without flux, removing oxides from material that will not brighten or polish, hardening of high-speed and high carbon-high chromium steels without decarburization of any loss of brightness, bright drawing. Materials processed include: annealing of silver-magnesium, Inconel -X, niobium, tantalum foil, titanium; nicro-brazing of L-605 alloy, hardening of 410 stainless, Ni-Span C, beryllium-copper, M-1 high-speed steel.

Titanium-base alloys cover a wide range from the all-Alpha phase to the all-Beta phase. Combined Alpha and Beta alloys, resulting from various additives, offer the widest range of properties. However, new all-Beta alloy, B120VCA, provides maximum ease of forming plus hardenability. Machinability is about the same as for earlier compositions



Now...Ti alloys you can form and harden

PITTSBURGH—Three new workable titanium alloys, which also can be heat treated, have been developed by Crucible Steel Company of America. One of these new materials, called B-120VCA, is the first heat-treatable all-Beta titanium alloy to be produced.

Called "formageable" (Crucible's registered trade mark description) all three alloys are capable of being readily formed in the so-called solution treated or "soft" condition and then strengthened by simple thermal aging. Strengths obtainable with each of these alloys are higher than previously possible in titanium sheet materials. In fact, Crucible claims that the new Beta alloy represents a major technological breakthrough for the titanium industry —comparable to the development of austenitic stainless steel.

Expected to find wide use in advanced aircraft now being developed, these new alloys show real promise of recapturing some of the market now going to precipitation hardening stainless steel and the high hot-hardness tool steels being used for aircraft and missiles.

Pure titanium (called Alpha) is normally in hexagonal-close-packed crystal form, in company with magnesium, zinc, and cadmium. This is the least formable condition of the three crystalline forms common to most working metals and is the reason why these materials must be formed hot.

When titanium is heated above 1625F all of its crystal structure changes to body-centered cubic, which is much more formable than hexagonal close-packed. The trick is to keep it this way at room temperature. Like iron, titanium has both low and high temperature crystal structures. The high temperature structure of iron is called austenite; of titanium it is called Beta. Both structures can be stabilized to room temperature by large alloy additions. Between the Alpha and the Beta phases various alloying elements provide a wide range of Alpha-Beta mixtures with varying properties.

The need to stabilize titanium's high-temperature Beta structure down to room temperature, to secure the advantages of Beta's better formability, was the reason for the development of B-120VCA's composition. This stability was accomplished by the addition of 13% vanadium and 11% chromium. Now the very formable Beta structure was also potentially very hardenable because of its high alloy content.

Then 3% aluminum was added for proper balance of the alloying elements so that the structure stays all-Beta during forming and/or during slow cooling and ages to quite high strength levels at reasonably short times and low temperatures—but still does not over-age) either brittle or weak in service.

Annealing B-120VCA sheet with normal air cooling also solution quenches it to the soft, formable condition. In this form it has a minimum yield strength of 120,000 psi. Aging this material from 20 to 100 hr at 850-950F then strengthens it to 170,000 to 200,000 psi yield strength with good residual ductility.

Forming of channel sections, hat sections, and similar press-brake work is greatly simplified by this new alloy. Smaller bend radii generally can be used than are standard for A-70 or C-110M. Many operations requiring hot forming can be done at room temperature. More uniform elongation is obtained at 200 to 400F. Particularly noteworthy is B-120-VCA's ability to be cold headed. It is believed to be the alloy long sought for rivets.

For high strength-weight honeycomb foil at one extreme and for very thick heat-treated sections at the other, some mill products of B-120VCA, such as sheet and wire, are well into pilot production and are now available. Thinner sheet than 0.030 in., strip, foil, bar, billet, and other mill products have been made in limited quantities.

Dimension Tolerances on Four Typical Engine Parts

PART TYPE	FINISH SIZE (in.)	REQUIRED TOLERANCE (in.)	SIZE VARIATION PER 10° F. TEMP. CHANGE (in.)
HUB	16.9225	±0.0005	0.001
HUB	5.1225	±0.0005	0.0003
HUB	19.000	±0.001	0.001
SHORT SHAFT	5.75025	±0.00025	0.0003

When coolant temperature affects dimensions beyond tolerances . . .

Heat coolant to hold tolerances

Pratt & Whitney Aircraft, North Haven, Conn, found that too-cold coolant was causing rejects on large shafts and hubs for J-57 and J-75 jet engines. The parts gaged OK at the machine, but they ended up oversize after they heated up to room (and master-gage) temperature. Solution was to measure the master-gage temperature at regular intervals and adjust an oil-circulating heater in the coolant line to bring work temperature back up to par

Coolant too cold? It's possible when the operation is a final light grind on large-diameter parts. If the coolant is 10-15 F below room temperature, it can shrink the work 0.001 in., placing it well under a 0.0005-in. tolerance.

The coolant acts more as a lubricant than a coolant, and there is little cutting heat developed on light ID and OD grinds. The liquid is usually about 10 F below room temperature, and it therefore cools the work that much below gage temperature. The temperature difference fluctuates seasonally and daily, affected by variable heat losses, pumping rate (3-5 gpm), tank size (75-125 gal), temperature and volume of makeup coolant (15 qt/day), and other local factors peculiar to the grinding machine. The coolant tank, buried under the machine, is slow to warm up after a cool night, and there is evaporation cooling from the grinding wheel, the work itself, and from the table before the coolant drains back to the tank. Evaporation alone may reduce the coolant and work temperatures 1-3 F, which is equivalent to 0.0001-0.0003 in. shrinkage on the work.

TEMPERATURE CONTROL

It would have been impractical to try to hold the gage temperature constant, so the best solution was to control the coolant temperature in relation to the gage temperature. Thus the coolant was heated to the gage temperature, plus an allowance for evaporative cooling.

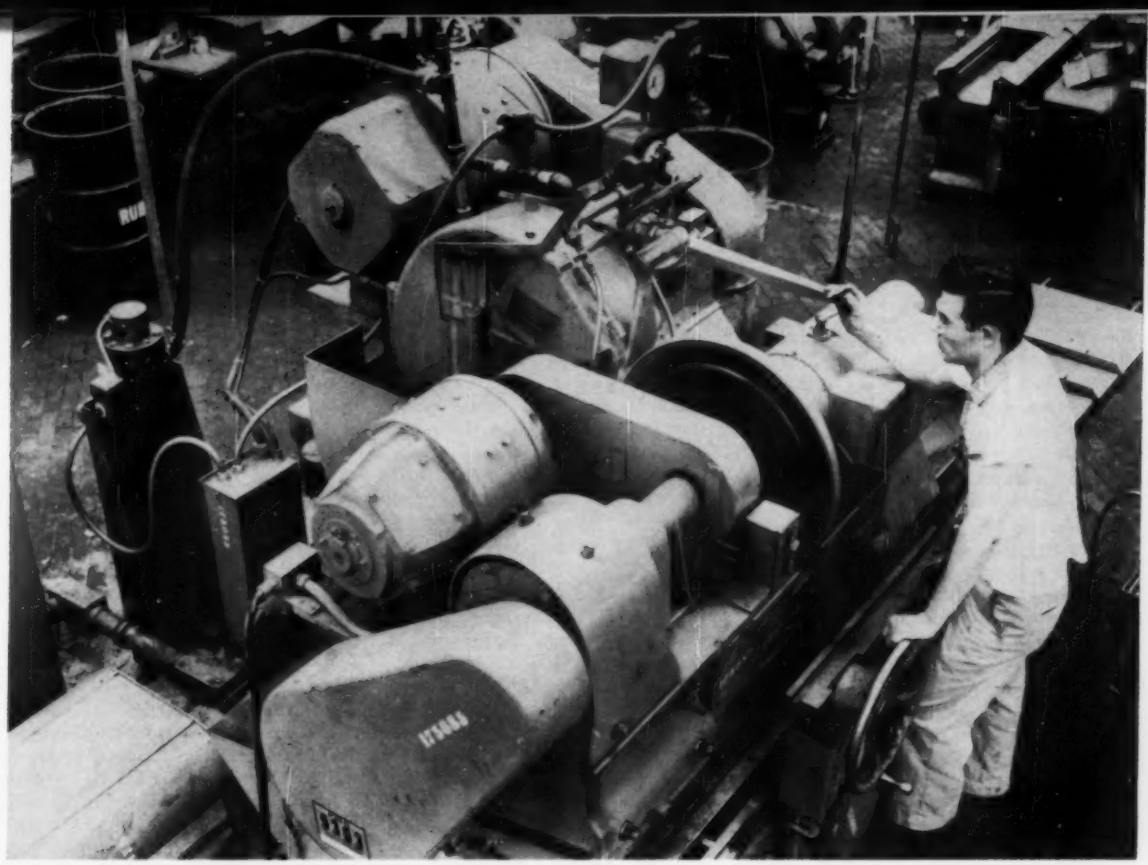
A Chromalox oil-circulating heater was installed in the coolant line between the supply tank and the grinder head. The unit has a rating of 6 kw and capacity of 20 watts/sq in. It is controlled by an indicating bulb-and-capillary controller on the grinder, with its sensing bulb in a T-fitting in the coolant line. Heaters were not installed in the tank because they would interfere with tank cleaning. In addition, the heater in the line only warms coolant as required, and starts up quickly.

Temperature at the master gage is checked with a pyrometer hourly, and the controller is set 2 F higher. This results in less-than-perfect conformity, because evaporative cooling varies according to temperature and humidity. However, control is close enough to keep the work within tolerances.

RESULTS GOOD

A single grinder was outfitted with a heater, and 24 hubs were finish-ground, gaged at the machine, then allowed to sit for 48 hr. They were gaged again and found to be within 0.0001 in. of the original gage reading. After six months of operation with the heater, the grinder has produced no parts with gaging errors because of heat differences.

Because of this success, the remaining finish grinders in the department are being equipped with the same heater arrangements.



Grinder is fitted . . .
with circulating oil heater (left behind machine) and sensing bulb of temperature controller inside T-fitting in coolant line (top, center)

Master-gage temperature . . .
is checked hourly with precision pyrometer, then controller at grinding machine is reset accordingly

Grinder-temperature controller . . .
is set 2 F above master-gage temperature, which allows for evaporative cooling of the work while in the machine and after

No recession for shipbuilders

–Even Navy's $490-million cutback fails to dent the boom

WASHINGTON—The nation's shipyards got a $490-million setback recently when Navy said rising prices was forcing it to cancel this amount of construction. On the plus side, however, Congress cleared the way for $200 million worth of new passenger liner work when it okayed building of two new ships.

In spite of the latest juggle in government plans, the shipyards are the busiest they have been in peacetime history with a current and projected multi-billion-dollar ship construction program that is designed to keep the yards busy for the next 10 years or so.

There is a strong chance that the Navy's announced chop in ship construction will be partially restored by an additional grant of money from Congress. Actually, the Navy move was viewed by Washington observers with skepticism.

Navy Cuts 1957-58 Program

What Navy proposes to cut out of its program are ships authorized in the fiscal 1957 and 1958 programs. They are: four new guided missile frigates costing $50 million each, two destroyer escorts at $15 million each, conversion of two cruisers to carry guided missiles at $100 million each, and the equipping of an aircraft carrier to allow it to handle helicopters.

Primarily, this is new construction that has not been started, and is mainly slated for Navy yards to handle. It would cost an estimated $8 million for the Navy to retrench in its program, however. Congress is wondering if it might not be better to pump some additional money into the program and salvage the $8 million.

The Navy cutback came shortly after its 1959 budget had been approved by the House of Representatives, and just before it was slated to go before the Senate Appropriations Committee. It left a strong doubt about the undercurrents involved in the measure.

The big question was whether Navy had in fact made a $490-million blunder in handling its construction program or if the Service was merely being politic and using the cutback as a lever to get its 1959 budget jacked up a bit.

Speculation was that the administration—and the Secretary of Defense—likely had not allowed the Navy to ask for as much money as it deemed necessary in the original 1959 budget. The House of Representatives approved virtually all of the ship construction money Navy asked for, including several million for some 14 additional major vessels.

No Price Offset Asked

The Navy, for example, did not ask Congress for any large sum of money in the 1959 budget to compensate for increasing prices. In fact, Rear Admiral Albert G Mumma, Chief of Navy's Bureau of Ships, told the House Appropriations Committee that "normally in our regular budget we make provision for some repricing every year because we are sure that creeping inflation is with us at this time, and it costs additional money each year that we have not been able to budget for."

"Last year our repricing total for all programs was $22-million increase," the Admiral testified. Such reports, coming shortly before the $490 million announced cutback, left the situation in something of a quandary. It's a matter that the Senate is seeking to clarify.

$200 Million for New Liners

The sting of the Navy's cutback was partially offset by Congressional approval for the government to spend some $200 million to build two new passenger liners. The government will build the ships, then sell them to two commercial companies.

The United States Line will get a 35-knot, 2000-passenger ship to replace the aging SS America for service to Europe. It will cost the government around $120 million and cost the U S Lines $47 million. Construction subsidies and national defense features account for the difference in price.

American President Lines will get a 26-knot, 1450-passenger ship for Pacific service. It will cost some $76 million and be sold for $34 million.

In the mill is still a more spectacular plan to transport economy minded passengers to Europe. H B Cantor, New York hotel operator, is pushing a proposal to build two big passenger ships capable of handling 6000 one-class passengers on an a la carte basis. Fares would be $50 one-way with Pullman Company prefab accommodations and cafeteria service.

Congress currently has a bill under consideration that calls for the government to build the ships, then sell them on much the same basis as it okayed for the other two liners. Observers, however, don't expect the legislators to make a final decision on the matter this session. Unofficial cost of the ships is estimated at around $150 million each.

The recent activity is all part of the government's endeavor to get more fast, modern tonnage afloat in the passenger ship field. It is considered necessary both from an economic and defense standpoint.

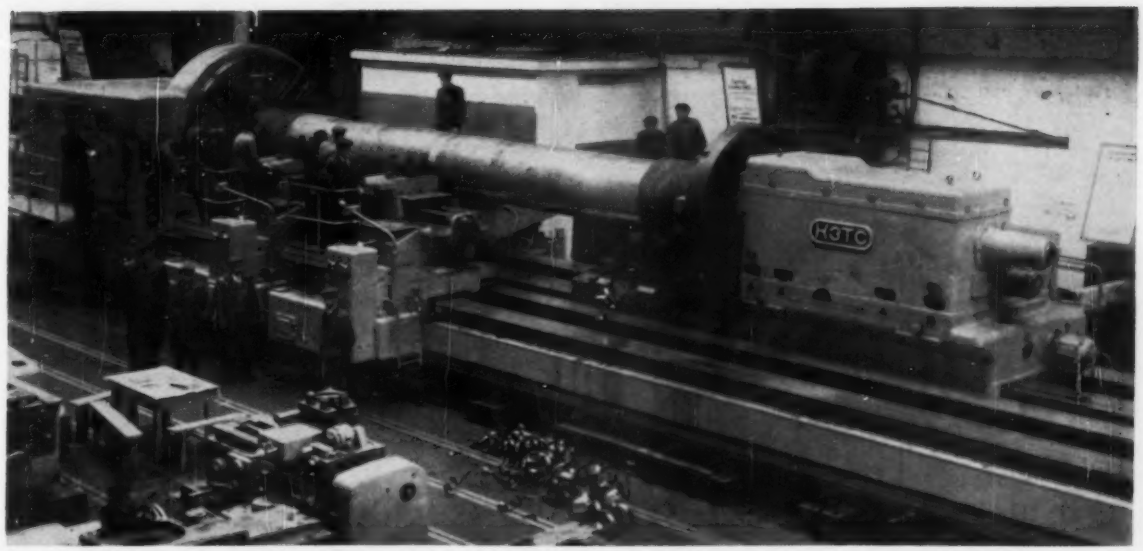
Recently, Grace Line's new $25-million luxury liner "Santa Rosa" started service to South America. It is the latest addition to the U S fleet of passenger ships—more are due to come. All however, are government subsidized in part.

Before the end of the year, three more liners will go into service. Coming up is another new liner for Grace Lines, the SS Santa Paula, sister ship to the Santa Rosa. Moore-McCormack Lines has two new passenger ships, the Brasil and Argentina, that are scheduled to replace aging namesakes by the end of the year. Cost of the three ships is around $70 million.

Recently, too, the American Banner Line's SS Atlantic sailed on its first transatlantic voyage to Europe. It is a converted mariner-class cargo vessel that can handle 900 passengers.

While most of the merchant ship construction is moving ahead at a fast pace, some tanker construction has been cancelled. Primarily this has been from the Greek ship operators. Attracting the most attention is the recent announcement by the A S Onassis combine to cancel the contract to build a 106,000-deadweight-ton super tanker.

Shipyards still have something like 50 orders for new tankers either building or on the books. In all, private yards have close to $1.5 billion in construction work in progress or ordered.



Largest lathe produced in USSR . . .
. . . is this 4 x 15-meter machine made by Crematorsk plant in the Ukraine. This plant makes only heavy lathes. This machine's swing would correspond to 13-ft in the U S, its bed to 50 ft. It is a standard unit

Russia revisited

R & D sparks Soviet drive for metalworking supremacy

Here is brand new eyewitness information on Russia's intensive research and development efforts in metalworking—updating and supplementing *AM*'s eight-part award-winning Report on Russia by Norman Stubbs and Peter Trippe (*AM*—Nov 19 '56 through May 6 '57)

Granddaddy of all Soviet transfer machines . . .
. . . is this 33-position cylinder-block line installed in the Minsk Tractor Works 11 years ago. It does all machining of the block, is based on a unit head developed at ENIMS, where the machine itself was built. Various plants have since developed unit heads they manufacture and sell

By E J TANGERMAN*

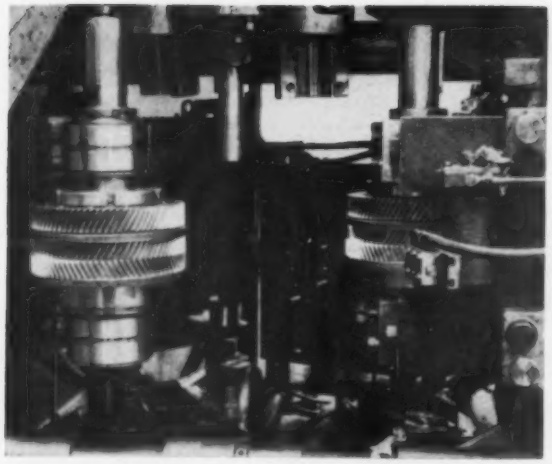
Russia's national Institutes—such as those for machine tools and cutting tools—are the heart of metalworking research and development in that country.

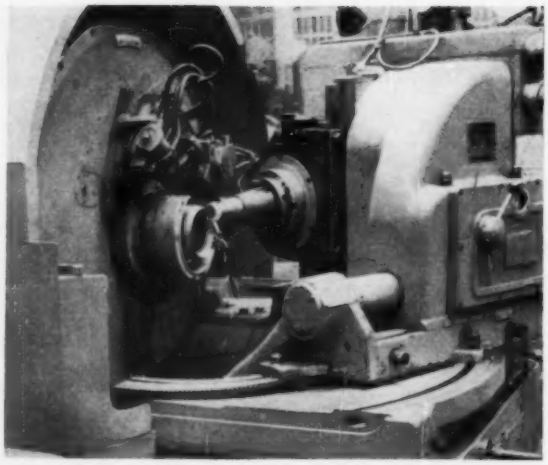
Originally set up as designing branches for Russia's various industrial ministries (others include blast furnaces, rolling mills, coal-mining machinery) the Institutes have survived the decentralization program that abolished the ministries themselves two years ago.

As might be expected, the Institutes vary with the industry they serve in size, efficiency, personnel and state-of-the-art—to say nothing of the availability of foreign equipment that can be bought and copied.

These Institutes do such research as cannot be undertaken successfully by individual plants—and they have other functions that can best be explained by describing a typical Institute which I visited—ENIMS (Ex-

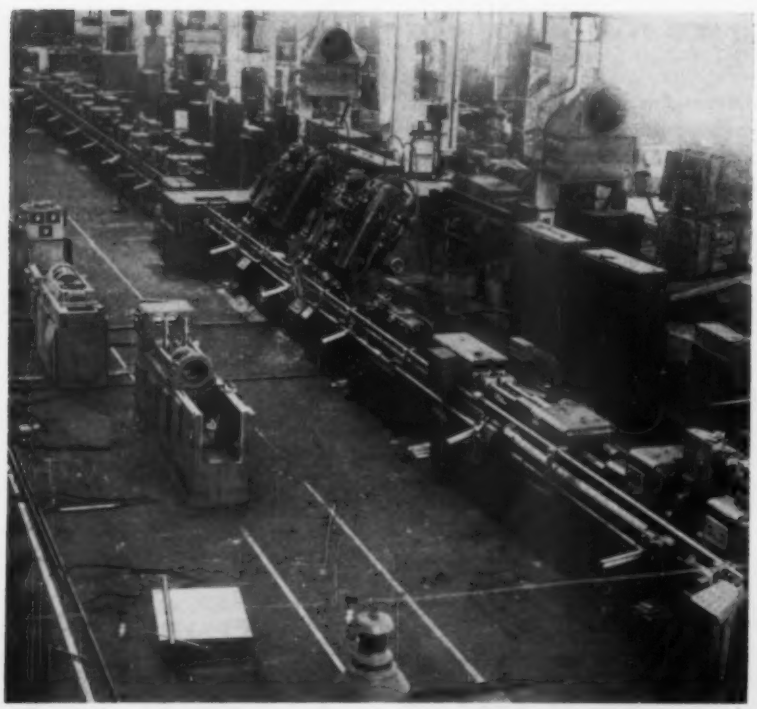
*E J TANGERMAN, for many years executive editor of *AM* and now editor of *Product Engineering*, spent two weeks in Russia covering new developments in design engineering. His report takes up the entire current issue of *Product Engineering* (July 14). Here is his report on Russian developments and methods of interest to the metalworking field.





Gears: roll forming . . .

Roll-forming of gears (left photo) is a current development project in Russia. Gears have been made successfully, but they aren't accurate enough for machine tools unless they are finish-ground—and that destroys the forged-tooth surface. Such gears in rougher machinery, however, have given excellent wear rates because of their hot-worked tooth surfaces. The cycle: blank periphery is heated with a high-frequency coil (coil and work arbor not shown in place) then rotated against the rotary tool. Burrs are created on the open face of the gear, but are easily removed. Thus far, only straight spur pinions have been made successfully. But other tooth shapes and larger gear diameters are being tried. Bevel-gear-making machinery such as that shown in right photo is expressly banned as a U S export to the USSR, so Russia has developed its own. ENIMS designs and builds machines such as this spiral-bevel grinder (Russia's largest) which is able to finish 800-mm gears



Russia's first shaft line . . .

. . . built in 1957, has grinding on centers (tall machines). Compared with the former method, the line upped annual output from 76,800 to 168,000 shafts—and labor was cut from 24 to five men. Output per man per year thus has risen from 3200 to 32,000 pieces, and the cost per piece dropped from 6.55 to 2.56 rubles—saving something like 744,600 rubles a year. (Official exchange is 4 rubles per dollar)

perimental Scientific Institute for Machine Tools).

Twenty-five-year-old ENIMS employs 1000 people, serves as a bellwether for all Soviet industry, because if machine tools are not made first and well, no other industrial products can be good.

In addition, ENIMS supervises the machine tool design work of 8000 people in various locations throughout the USSR, including those in specialty bureaus (milling machines and lathes, for example) as well as those in the design bureaus of tool plants.

ENIMS is an arm of the State Planning Commission, which supervises, directs and controls all Soviet production, and as such is responsible for development of a master plan specifying types, sizes, quantities and designs of machines to be built.

As such, too, it has detailed plans extending through 1965, showing when new types or sizes are to be designed, when built, and in what quantities. It is also the basic source of new designs and the testing laboratory for all Russian machine-tool factories, as well as the research center for projects too broad or difficult for the individual plants.

ENIMS has done many interesting design jobs through the years. During the years 1933 to 1947, for example, ENIMS was the sole de-

veloper and maker of unit-head machines. It also produced the first transfer line (for cylinder blocks) in 1946, has been the major factor in development of automated machine tools. It designed and built the automatic piston line that occasioned so much comment three years ago, as well as the ball bearing line publicized a year ago. It is now emphasizing flexibility in automated lines, has recently produced a gear line and a shaft line embodying this desirable characteristic. It also attempts to design new units so they will work either singly or in a transfer line. It produced nine machine tools for exhibit at the Brussels Fair, three of them program types (two copy millers, one lathe).

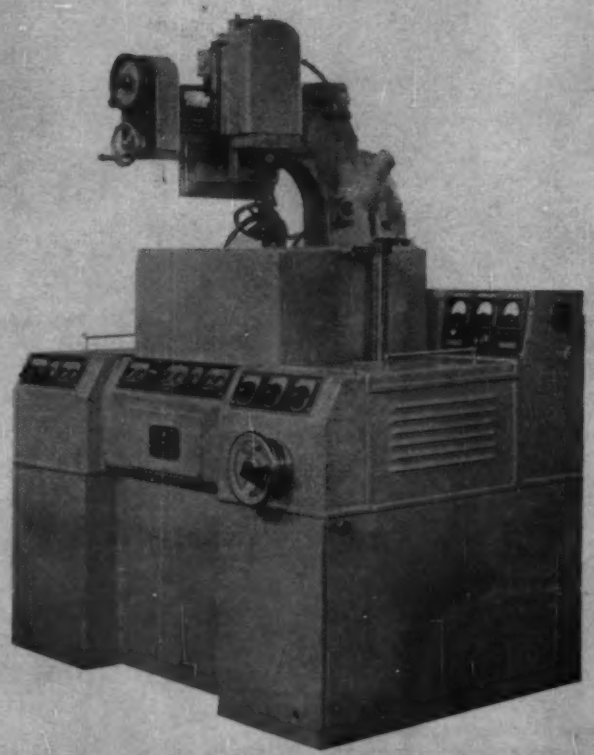
So many kinds of design, development and research work are done at this Institute that it is difficult to mention all of them. It tests Soviet machine tools against available foreign tools for the same job. Special electronics, hydraulics, and power labs test components and evaluate them for use in machines.

Standards for machine tools are worked out, parts and complete designs standardized. (In the Soviet Union, most production is of standard items in quantity, from components to complete units.)

Thus the standard machine tool incorporates standard bearings, gears, switches, and so on. Stepless speed variation is a current must.

At ENIMS, average time from idea or plan to finished drawings of a new machine tool is eight to nine months, or a year or even longer for a new transfer line involving machine units not currently available. (The automatic piston plant took four years from design to production—two of them for debugging.)

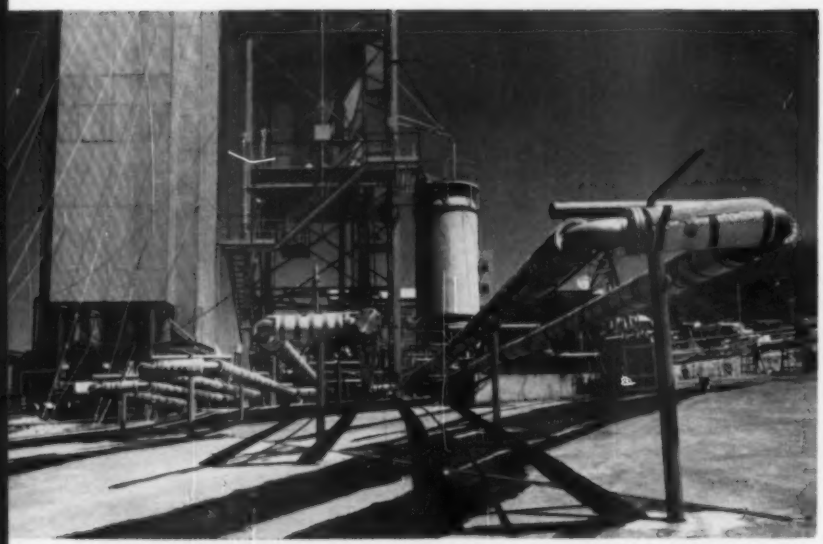
Here is Russia's hottest new metalworking development



The United States was the discoverer of the tap disintegrator, then the Russians came along with electrical-discharge machining—now have thousands of well-designed machines like this one in use. A recent discovery substitutes a graphite tool for the conventional brass one, employs interrupted (rather than continuous) discharge. This increases the rate of metal removal 10 times—from 400 or 500 to 5000 cu mm/min, but it produces a rough finish. Final finishing must then be done at conventional rates with conventional tooling

Russia's highly flexible new gear line . . .

. . . makes gears from 80 to 250-mm dia (3 to 10 in.) and 2 to 6 pitch. Start is at left. All machine units have the same table height, so designed as to be used in a line or individually. Sequence of operations: (1) rough turn (3 tools) and bore, (2) finish turn (2 tools) and bore, (3) broach bore, (4) chamfer and recess face, (5) store gears in a center bank so either half of line can be shut down for tool change or maintenance without stopping the other half, (6) hob, (7) teeth, (8) chamfer, (9) shave. Note how machine is designed for flexibility—machine interchange or separate use—and can be serviced without total shutdown. This line cost 2-million rubles, today can be produced for 1-million rubles



Point Loma installation . . .
tests flow and pressurization of liquid oxygen and hydrocarbon fuel with towers at left and pipes in foreground. Stands in rear are for structural tests of missile frames. Strain-gage data is reduced to coded tapes, then converted into digital information so results can be graphed for analysis

100-G centrifuge . . .
will swing 1-ton load at 121 rpm, and can be refrigerated to –100 F or heated to 350 F to temperature-test the load. Largest on the West Coast, it has a 10-ton steel boom 40 ft long. Vibration will be combined with centrifugal force when shaker mechanism is added. Smaller unit will test 100-lb loads to 20 G's

Convair's Atlas Demonstrates . . .

Tests for Space-Age Components

R S CAMPBELL, chief of test labs, CONVAIR-ASTRONAUTICS, SAN DIEGO

Missile tests form a pyramid, with many part and component tests at the bottom, subassembly and assembly tests next, then subsystem tests, and finally the single big test—flight. Preliminary tests require unusual techniques and often unusual equipment. Here are examples of how a whole missile is tested by its individual parts

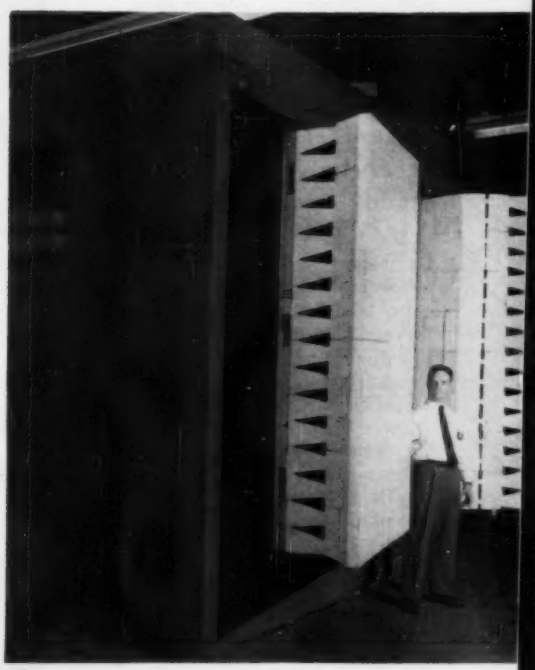
Atlas ICBM's that are to travel 6325 miles at 15,000 mph go through the most intensive and exhaustive test program ever applied to Metalworking products—but they are tested as subassemblies and pieces, not as full assemblies. The nearest thing to a full-function test is captive firing, carried on at Sycamore Canyon near San Diego. Handling, fuel, and structure tests are made at Point Loma, but the detailed tests made on each part of the final missile assembly are made in the main plant.

An average missile has 40,000 parts, not counting nuts, bolts, and the like. These are inspected, gaged, strained, and measured before they get close to the missile. For this purpose a set of primary standards is maintained, and checked periodically at the National Bureau of Standards, so accuracy is verified often. The standards are applied to check all gages and inspection devices and to calibrate all instruments for in-flight measurements inside the missile.

Each test is made at the lowest possible level of design and manufacture to catch any errors or deviations quickly. Firing tests, for example, are not made to check the engines, but to test the compatibility of the airframes, engines, and autopilot systems. Pumps, valves, and other elements in the propulsion system all receive their own independent tests along before firing.

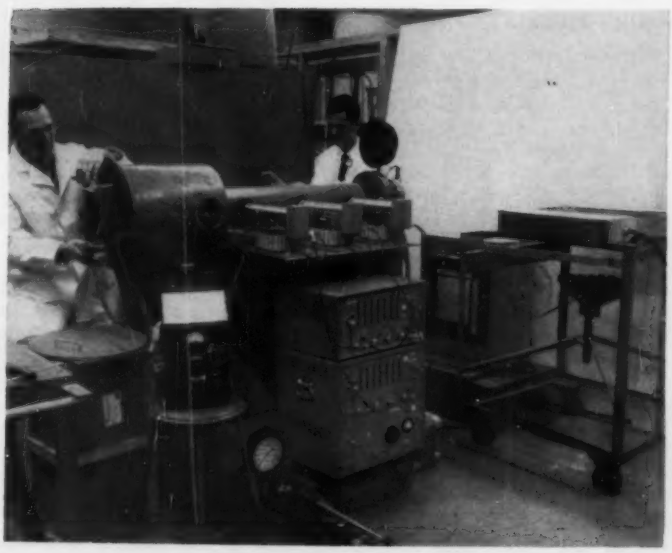
Tests pictured here are typical of the wide range of examinations that must be made.

Sine-wave shaker . . .
produces 25,000-lb sinusoidal force and 42,000-lb peak random force to test missile parts



Free-space room . . .
simulates radio conditions when missile is in flight, to allow testing radiated energy from antennas. Walls and doors are 2 ft thick and made with pyramids of material with a high coefficient of absorption to radio-frequency energy. Signals from within can pass out, but none can go in

Thirteen environment chambers . . .
simulate altitude up to 180,000 ft, humidity up to 100%, temperature from –100 F to 350 F, and three chambers will add rainfall torture. Two of the chambers will throw sand or dust of various particle sizes, and one introduces salt-water spray. Any atmospheric condition can be operated as long as required for any test



Pellet gun . . .
tests materials for resistance to penetration by small meteorites. This is one of several special machines built by the laboratory because no suitable equipment was available for the job

Lazy-susan worktables cut assembly costs

BEN C BROSHEER, associate editor

Rotary-indexing worktables with interchangeable work centers replace straight workbenches for progressive assembly operations

Lazy-susans are no longer restricted to the dinnertable or to buffet luncheons. Modified versions of these rotary trays are finding increasing application in industry. Here at General Electric's General Purpose Control Department plant in Bloomington, Illinois, they are used for many of the subassembly and final assembly operations on most of the more than 135 basic families of control units in the plant's product line.

These round, indexable, four-position worktables are as easy to tool for progressive assembly as the straight benches they replace. The table tops, 78 in. in dia and 30 in. high, are faced with long-wearing Masonite and are mounted on ball-bearings above the table's angle-iron frame. Because they can be turned 360° in either direction by simply depressing a spring-loaded pedal, the tables can be used just as efficiently by only one or two operators—when work loads are light—as by the full complement of four operators.

Indexing worktables . . .
can be used efficiently with an operator at each station or with only one or two operators. Interchangeable plywood quadrants carry tooling and parts bins

Rotary storage racks . . .
hold up to twelve quadrants each. Handlers refill parts bins while quadrants are in rack. About twenty quadrant changes are made each week

HIGHLY FLEXIBLE

The flexibility of this work-station design is used to its greatest advantage in the plant's Miscellaneous Devices Area, where job quantities are low and where jobs may be changed as often as five times in a single eight-hour shift. Any order calling for 30 to 40 assemblies is considered a large job.

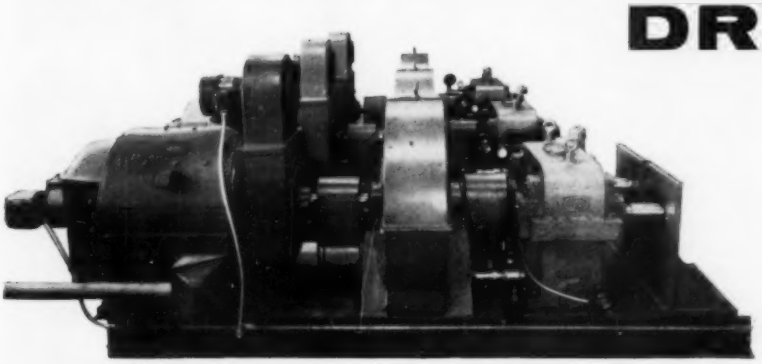
Here, both of the round, four-station assembly tables are fitted with Masonite-faced plywood quadrants. These interchangeable quadrants are permanently tooled for carefully worked out groups of assembly operations. Each quadrant carries racks of open-end pans for small parts and hardware, and is fitted with the necessary locating fixtures. Should more than one station be required for any given assembly, the quadrants involved are fitted with chutes for moving the assemblies along to succeeding stations. Air-operated tools supplied with quick-disconnect couplings can be suspended from gantry arms above the center of each worktable.

Materials handlers use an overhead air hoist to move the quadrants between tables and either of two structural-steel storage racks when changing setups. Each rack holds up to twelve tooled quadrants. The three rotatable, four-position storage shelves of each rack are faced with wheel-conveyor sections to speed in-and-out quadrant handling. Between the two racks is an electric-powered Rapistan elevator, whose elevating table is equipped with a section of roller conveyor. This unit helps the materials handler position the tooled quadrants for pickup by the overhead hoist or for storage in the triple-tiered racks.

American Machinist Special Report No. 462 JULY 14, 1958

HOW TO **CHOOSE** AND **USE**

ELECTRICAL ADJUSTABLE-SPEED DRIVES



E H DINGER
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Whether we talk of automation, or mechanization, or just good machining practice, speed control is a vital ingredient of the conversation. Inadequate control can make or break a production system. Inefficient control can lose many dollars in delays, in power losses, in tool breakage, in poor product quality, and in countless other ways. This report gives the fundamentals of electrical, including electronic, adjustable-speed drives and describes the essentials of selection and operation that determine efficient performance.

Adjustable-speed drives are used in almost all segments of metalworking today. Applications cover the range from controlling small drillpresses to highly automated production lines.

Where drive speed is the primary variable affecting product quality or rate of production, the need for a drive which will consistently maintain a particular operating speed is readily apparent. In many applications, however, product quality is affected by a number of variables, only one of which is speed. A practical solution to this problem is to try to obtain maximum control of each of the variables individually. Thus, controlling speed to that degree of accuracy at which its effect on the end product is truly negligible eliminates speed variation effects.

While the vast majority of adjustable speed applications can be satisfied by drives covering a 10 to 1 speed range, a growing number of applications require speed ranges of 200 to 1 or more. Characteristics of the power element determine the ultimate limit on the practical obtainable speed range. In a dc motor drive, it is the *motor* that establishes the ultimate speed range.

One limit imposed by the motor is heating. At low speeds, the self-ventilated dc motor generates much less cooling air; at speeds below 1/20 of rated, self-cooling is negligible. If the motor is to be operated only for short periods of time at low speed, with longer periods at high speed, motor heating may not constitute a speed-range limitation. Furthermore, if the motor load is substantially reduced at low speeds, operation may be satisfactory even for extended periods at low speed. Where the motor is required to operate at full load for long periods at low speed, it usually will overheat and insulation life will be reduced, sometimes drastically.

Motor heating at low speeds can be solved by selecting a motor rating matched to the duty cycle of operation. This may require a motor in a larger frame size or one that is blower ventilated.

Another limitation is "cogging," or the inability of a motor to run smoothly at very low speeds. One reason for this phenomenon is that the rotor is not continuous but rather contains a series of alternate conductor slots in the iron. As each of the iron segments approaches the field pole, small variations in torque result from small variations in the magnetic path, causing a slight unevenness in rotation which is much more noticeable at low speeds. By skewing the rotor slots so that they are not parallel to the edges of the field poles, this effect can be minimized. Skewed slots are frequently used on motors applied to wide speed-range drives.

"Cogging" at very low speeds also results from variations in friction

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and from the difference between static friction and sliding friction. If, when running at a very low speed, there is a momentary slight increase in friction, the motor may stop and after stopping the friction required to start it moving again will be the larger static-friction value. If the motor is supplied from a dc source, it probably will remain stopped. If it is supplied from a regulated system, the regulator will increase the armature voltage to start it moving.

However, because the regulator will have to supply a larger voltage to get it started than to keep it running at the low speed, the motor will momentarily accelerate to higher than preset speed and will then reduce to the correct speed until another variation in static friction appears. The resulting motion will be of a halting nature about which nothing much can be done except to improve the friction characteristics of the motor and the driven load—for example, add a flywheel.

Total overall speed range can be increased by using a motor having part of its speed range above base speed. Because, however, the rated torque of such a motor in the weak-field range drops off inversely with speed, the motor can be used economically only if the torque requirements of the load somewhat match the torque available from the motor.

Limitations at the top end of the speed range involve mechanical considerations, commutation at high currents, and stabilizing. The primary mechanical limitation at high speed is the inability of the armature conductors to resist the centrifugal forces tending to throw them out of their slots. The ability of the motor to commutate properly is limited both by the amount of current and the speed.

For drives operating above base speed, stabilizing of a closed-loop speed-regulating system becomes somewhat more difficult. First, the mechanical time constant of the motor increases as the square of the ratio of the weak-field speed to base speed. Second, if the system employs tachometer feedback, the system gain increases by an amount progressively as the drive speed increases above base speed.

REGULATION

Two common methods of regulating dc motor speeds are:

1. Regulation of armature voltage by increasing armature voltage as a function of motor-armature current (IR-drop compensation).

2. Regulation of speed directly with a speed-sensing device (tachometer) for reporting the actual speed to the speed regulator.

Both methods are capable of operating a motor over a wide speed range, but the latter can provide a wider speed range and greater accuracy of speed regulation.

Armature voltage regulation with IR-drop compensation offers a compensating scheme. That is, while voltage is regulated, that voltage is modified to compensate for the *cause* of a speed change. Maintaining a constant speed, therefore, depends upon providing compensation that will match and cancel out a particular cause of speed change. Because applied load will change speed as a result of the voltage drop across the motor armature resistance, speeds are maintained by increasing directly, as a function of armature current, the armature voltage. To the extent that the effect of load on speed is not a linear function of armature current, the compensating scheme falls short of perfect speed regulation.

IR COMPENSATION

At any particular speed, there is a value of IR compensation which provides almost "flat" regulation of speed between no load and full load. At other speeds, however, the same amount of IR compensation causes the speed to either rise or fall somewhat between no load and full load. Consequently, when IR compensation is used the compensating adjustment is normally set at the lowest operating speed where a small rpm speed error causes a large percentage variation in the low-speed value, whereas the same speed error at higher speeds would result in corresponding lower percentages of those speeds. Another reason for setting the IR compensation at low speed is that if it were set at top speed, for example, the motor would almost surely stall before reaching full load at lower speeds.

Several aspects of the IR-drop-compensation scheme establish a lower speed limit on satisfactory operation. One of these is that the no-load to full-load characteristic is not affected by the resistance drop in the armature alone but by other effects which are not linear functions of load current. Therefore, regardless of the accuracy of the armature voltage, there is no value of a linear IR compensation circuit which will produce an absolutely flat no-load to full-load regulation.

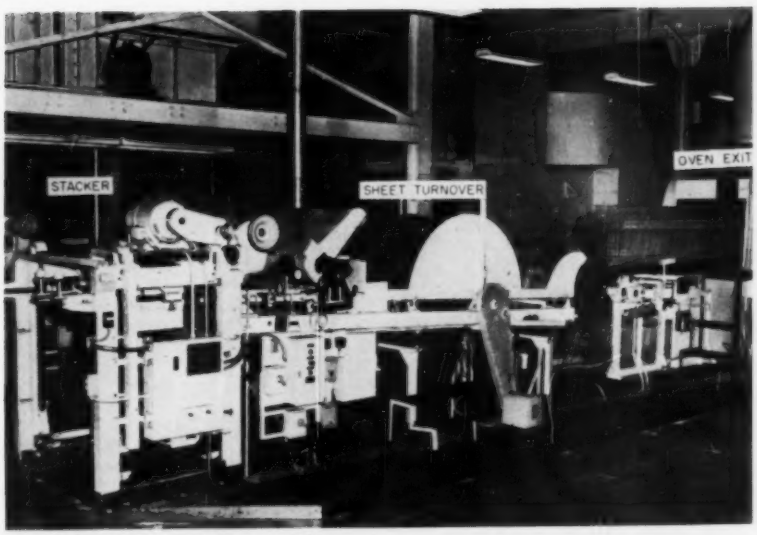
Another aspect is motor heating,

Speed-drift accuracy . . . is improved by mounting all amplifier components in a thermostatically controlled box. Thermostat and resistors, used as space heaters, maintain box temperature at a constant value higher than outside ambient temperature

which results in a different IR-drop compensation requirement as a function of armature temperature. For example, a value of IR compensation which will provide essentially flat compensation at low speed with a cold motor may allow the motor to droop badly, or even to stall, when the motor is up to temperature.

Still another cause is an abrupt change in load—which may cause the motor to stall before the IR compensating circuit is able to act. It is possible, particularly if static friction is considerably higher than running friction, that the motor may remain stalled. At very low speeds it is also very likely that the stalled current may be appreciably lower than rated current.

As a result of these deficiencies in the IR compensation scheme, the only satisfactory method of operation at speeds below about 1/50 of base speed involves direct-speed feedback or tachometer feedback. A wide-range direct-feedback speed control



Synchronizing between sections . . .
of this metal-decorating line is done by selsyn-controlled, amplidyne-powered dc drives

system involves, primarily, three critical functional elements:

1. A highly regulated reference voltage
2. An extremely accurate speed-measuring element
3. A stable high-gain amplifier

The accuracy with which the ultimate speed is maintained can be no greater than the constancy of the reference voltage which establishes the desired speed level. Hence, in wide-speed-range systems the reference voltage must be obtained from a regulated source, such as a voltage regulator tube, zener diode, magnetic reference, or other stable supply. However, the error introduced by the reference voltage is a percentage of operating speed regardless of the speed range.

Similarly, accuracy of speed control depends directly on the speed-feedback element and the accuracy and consistency with which it represents the actual output speed. In a dc tachometer feedback there are several sources of error, all of which are proportional to operating speed. Errors associated with the tachometer itself include:

1. Temperature errors. High-accuracy tachometers are available which incorporate temperature compensation to reduce errors resulting from temperature changes to a very low value.

2. Rotor eccentricity errors are particularly bothersome because they occur at a frequency of once per revolution, hence are more difficult to filter out than commutator ripple.

3. Commutator film breakdown error is caused, in normal operation, by a film that develops on the commutator. This film causes a resistance which remains constant if the load drawn from the tachometer is not excessive. For one particular tachometer, excessive is defined as the current drawn by a load resistance greater than a one megohm load across the tachometer. For loads appreciably higher than this the film will break down erratically with an attendant change in output voltage at any given speed. For loads below the critical value the output voltage will be stable within approximately $\pm 0.05\%$ and for loads above the critical, the output may vary by amounts up to $\pm 0.25\%$.

4. Rotor-end-play error results when the rotor is free to move axially, thus causing small changes in output voltage because of changes in the magnetic path. Tachometers are available with spring washers which cause the rotor to maintain a fixed axial position to minimize this error.

A stable high-gain dc amplifier is essential for accurate wide-range speed control. Stability means that all stages of the amplifier, and particularly the first stage, should consistently produce the same output voltage or current for the same input. To the extent that the amplifier is not stable by this definition, an error is introduced into the output speed and this error cannot be corrected by merely increasing gain or by increasing the accuracy of the reference or feedback. Errors of this nature are especially undesirable as they represent rpm errors, regardless of the operating speed. Consequently, they can cause large percentage errors at low operating speeds. Of the many techniques available for improving the stability of amplifiers, one of the simpler is stabilization of the supply and tube filament voltages.

For very high stability, however, it is necessary to introduce a certain amount of "drift-free" gain into the amplifier. "Drift-free" gain can be obtained by converting the dc error signal between reference and feedback into an ac signal, amplifying this by means of an ac amplifier or transformer, then discriminating and rectifying the ac amplifier output to again produce a phase sensitive (but amplified) dc signal.

The effectiveness of the "drift-free" amplifier in reducing the error can be described as follows:

Suppose that an error voltage of X volts exists without the "drift-free" amplifier connected and that this error voltage may be the result of drift in the first amplifier of the speed regulator, temperature change, line voltage variations, or load change. Then the error voltage with the "drift-free" amplifier connected will be X volts divided by the gain of this amplifier. This amplifier reduces the error resulting from any cause except reference or feedback inaccuracies. It also effectively increases over-all system gain by the amount of its own gain.

For this reason, the addition of this circuit will affect the stability and dynamic response of the over-all system in addition to accomplishing its primary purpose of reducing the random drift error. As a result, the stabilizing techniques employed must take this fact into account. Frequently, to minimize the system stability problem, networks are introduced into the "drift-free" amplifier to cause its influence on the over-all system to be a slow corrective signal.

NO DRIFT

With the addition of this drift-free circuitry to a direct-speed feedback system, the steady-state regulation at all speeds over a wide speed range will be extremely flat and constant. Low-speed performance will be limited only by the motor and driven-load friction characteristics. Transient performance will, however, still depend primarily on the characteristics of the control amplifier and power amplifier components and will not be materially improved by the addition of the "drift-free" amplifier.

This amplifier will reduce to a

very low value all sources of speed error except those of the tachometer itself, the reference voltage, and the input comparison circuit. Because the comparison circuit, if it is the parallel-feed type, is composed of resistors, it may introduce small errors as a function of temperature. These errors can be minimized in two ways. First, wire-wound resistors can be used, each of which is made of wire of the same temperature coefficient of resistance. The other way is to control the ambient temperature surrounding these resistors.

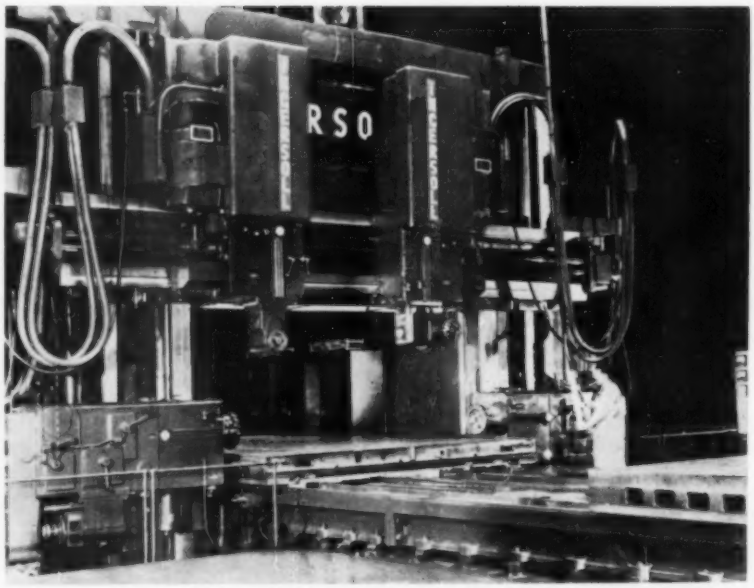


Table speed . . .
of this large planer-miller is adjustable over a wide range. In this application, rapid changes of speed are not essential but it is important to keep selected speed constant, regardless of change in load

RESPONSE

Most of today's adjustable-speed-drive applications require no special transient performance characteristics and most general-purpose drives are adequate. However, as industrial processes or machine operations are speeded up or made more precise, the drives powering them may be called upon to react quickly to sudden changes in command or load. Thus, transient performance capabilities can be critical.

Examination of the characteristics of a system which have a bearing on its response will help one understand the techniques used to improve transient performance. These characteristics or factors include:

1. Drive time constants . . .

Most of the elements in an electrical drive system contain parameters which introduce time lags to slow down response. The inductance in the drive-motor field and in the armature windings prevents instantaneous buildup of current and resultant magnetic flux. As it is the interaction of armature and field flux which produces the torque necessary for the motor to respond to changes in load or command, response is slowed. In many electrical systems additional power amplifier stages in the circuit before the motor also contain such time constants. Examples include the dc generator in a Ward-Leonard system, and the amplidyne or similar rotating amplifiers.

Electronic voltage amplifiers, which supply control for the power elements in the system, are usually fast responding and contain negligible time constants when compared to the power elements of the system, as voltage is not delayed in the same manner that inductance delays current and flux. However, the voltage across a capacitor cannot change instantaneously, as a finite time is required to charge or discharge a capacitor through a resistance. Capacitors are used in amplifiers for filtering out unwanted ripple or hash. In addition, closed-loop systems can be unstable or oscillate as a result of the combination of these time lags and the high gain necessary in such systems. If series stabilization utilizing capacitor-resistor networks in the amplifier is used to correct the stabilizing problem, additional system time constants may be added by the networks.

2. Load and motor inertia . . .

The inertia of a rotating body is a measure of the kinetic energy which the body is capable of storing. If a change in reference in an adjustable-speed drive calls for a new speed, it is necessary for the control to supply accelerating torque in proportion to the inertia of the system or to accept negative or decelerating torque in the same proportion. Thus the higher the inertia of the driven load on the motor, the slower will be the response to a change in reference, for a given drive torque rating.

3. Power capacity of the control and motor . . .

Preceding paragraphs have emphasized the concept of torque supplied or accepted by the drive under transient conditions. The maximum armature current which the control or motor can handle, provides a limit to the torque which can be transferred to obtain shortest response at various speed and load conditions. If a drive is lightly loaded and a change in reference is called for, there is sufficient torque available to provide rapid response to the command. The response at heavy load however, depends upon the capacity of the motor and control above rated values.

4. Reaction of driven load to sudden changes in torque . . .

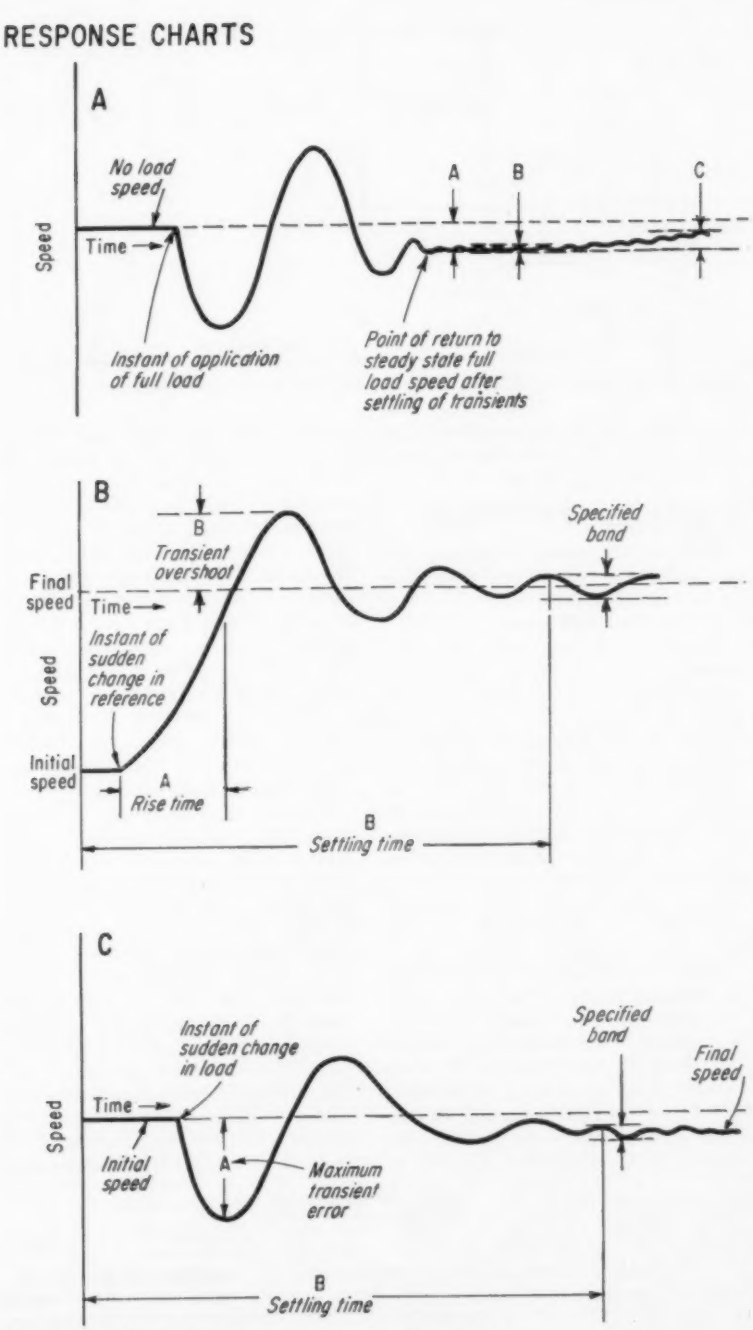
In some instances, torque capabilities of the control or drive motor may not be fully utilized if the driven load is not designed to handle such torques. The manner by which torque is transferred is also important. If a chain coupling is used, a sudden application of torque from the drive may throw an impact load on the driven section.

A belt connection may slip with sudden application of torque so that the load does not utilize the response available from the drive. Gears and shafts may cause backlash and wind-up which complicate the stability of the system. This is often a serious problem because the drive manufacturer may not have this information available when designing.

TECHNIQUES FOR IMPROVING SYSTEM RESPONSE

1. Effectively shortening drive time constants

A. Optimum stabilizing is perhaps the most important factor in obtaining the ultimate response inherent in the system. If a drive is tailor-made for one particular installation, the stabilizing and gain components



Response chart shows how various factors affect speed

may be selected to fit that application exactly. However, fitting takes time and money, not only from the designer's standpoint but the user's too, because the user must furnish detailed characteristic information on his equipment to the designer so that the drive may be set up to an optimum point.

Sometimes the designer even recommends changes in the user's equipment, if stringent response specifications are to be met. For some more elaborate systems it is not practical for the drive manufacturer to set up the drive under actual system conditions before it leaves his plant. Then it is necessary to allot sufficient time at the user's installation for the final tune-up.

General-purpose drives must be designed with flexible gain and stabilizing circuits which are suitable for the majority of applications and which may be adjusted in the field to improve response. Turning the gain down low will make most drives stable but sluggish. For optimum performance, gain should be left reasonably high and stabilizing accomplished by adjustment of the stabilizing circuits. Successful application of general-purpose drives lies in co-operation and interchange of information between the design, application, and field engineers representing both the drive manufacturer and the user.

Two broad classifications of stabilizing techniques are widely used in industrial systems. The first of these, called *series stabilizing* uses resistor-capacitor networks within the control dc amplifier. Easily adjustable rheostats are often substituted for the resistance section of the networks and a switching or jumper arrangement is provided to readily change the amount of capacitance in the network. Thus the network may be varied over a wide range without requiring any addition to or modification of the control circuitry as supplied by the drive manufacturer. Another stabilizing technique uses feedback signals, which sense a change in armature or field voltage, or speed may be fed back in a degenerative sense.

B. Range circuits and preconditioning simplify control problems. Many capacitors may be present in the amplifier. If these capacitors are allowed to change to a voltage level far enough from operating range, the drive will not respond quickly to desired commands. The drive designer provides circuit techniques to hold the drive in range for snappy operation. *Preconditioning* is a special case of range circuitry in which the drive is held in range during standby, so that it will respond rapidly when the "start" or "jog" button is pressed to start the motor. In addition, preconditioning provides a smooth starting of the drive under controlled torque conditions.

C. Load anticipation smooths operation. In some applications load is applied or removed by a switch or button by the operator. The same control may provide interlocks to the drive so that the control output to the drive motor may be turned on or off more rapidly than normal by load-anticipating circuits, to provide better response characteristics.

2. Changing system inertia

If a minimizing speed dip or rise with sudden application or removal

of load is of paramount importance, additional inertia added in the form of a flywheel attached to the motor is many times the easiest solution. However, remember that increasing mass lengthens recovery time to steady-state values as well as accelerating and decelerating time.

Gearing is usually present to couple the drive motor to the load and to correctly match speed ratios. Because the load inertia which the motor sees is modified by the gear ratio, selection of motor speed rating may permit gearing which will lower the effective load inertia. Thus, the motor inertia itself may be capable of ironing out speed dips or rises resulting from load change. If, on the other hand, rapid response recovery time is more important, motors having less inertia may be desirable.

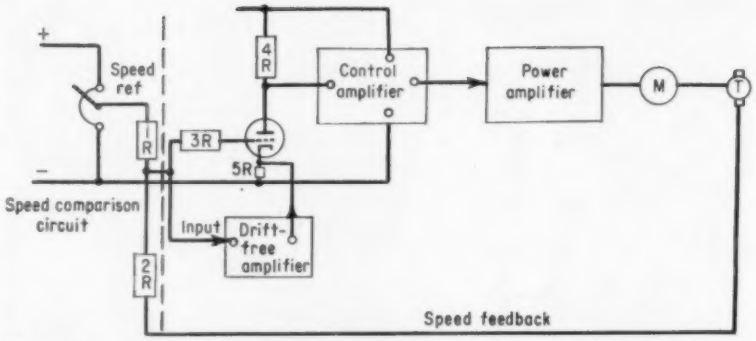
3. Effective use of power capacity of drive

Knowledge of short time ratings of the power elements of the drive are important in optimizing response. Thermal capacity is of primary importance in the motor because heating increases as the square of armature current, and the motor must be capable of dissipating the heat produced if armature current is increased to produce additional torque for response.

Commutation of the dc motor is also important at higher speeds when heavy currents are drawn. Short time capacity of the power rectifier elements such as thyratron or ignitron tubes, magnetic amplifier reactors, and rectifiers are also important. These limits are usually above the motor capacity and the drive designer includes fusing or other overload protection to assure that they are not exceeded.

Many drives provide an adjustment of the maximum output of the drive. Current limit for example, is a drive feature which holds armature current at a desired maximum value. In standardized drives, maximum current limit may be higher than that recommended for the motor on a particular installation. Users should see that motor life is not shortened by current limits set too high to obtain better response.

Timed acceleration and deceleration control, if provided, can be adjusted for a time long enough to hold drive output to a reasonable value during the accelerating or decelerating periods. As the power required for optimum response may exceed normal running power by a considerable percentage, it may be necessary to select an oversized motor or control if the short-term rating is not sufficiently high.



Typical method for introducing "drift-free" gain into a speed regulator

CONTROL OF ACCELERATION & DECELERATION

Two generally used techniques for accomplishing control of acceleration or deceleration are:

A. Current limit control

Torque over and above that necessary to maintain drive output speed constant for a given loading must be supplied to accelerate to higher speeds. Because torque output of a dc adjustable-speed drive is a function of motor-armature current, adjustment of this quantity is a direct method for controlling acceleration. If the drive is capable of regenerating, negative torque accepted by the drive from a decelerating or overhauling load may also be controlled by armature current.

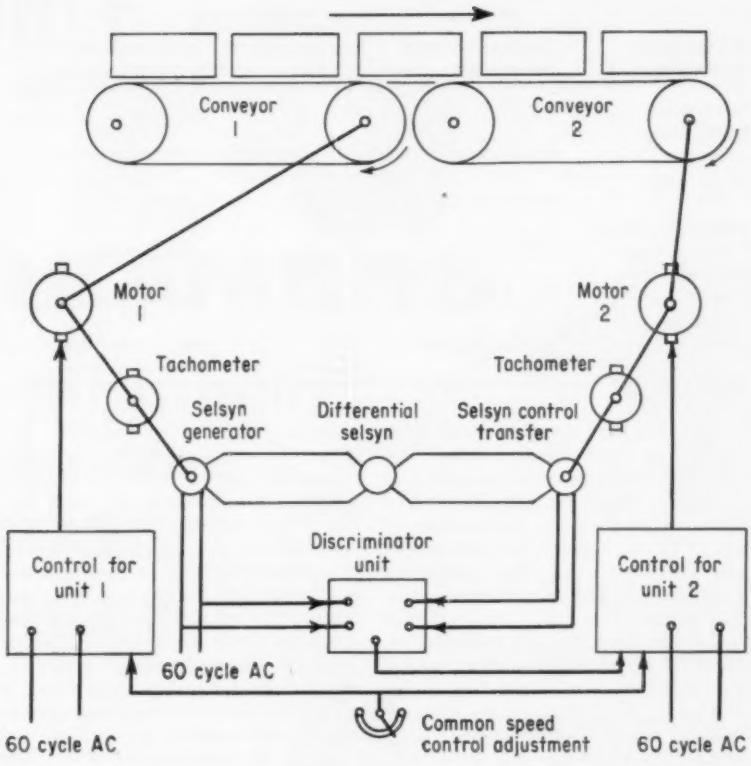
This feature, called *current limit*, operates as follows: The output from a current sensing device in the motor-armature circuit is first translated into a dc voltage signal. This signal is biased off to have no influence on drive operation during normal load conditions. However, if additional armature current is called for to accelerate the load, the voltage from the current device would rise above the bias voltage and take over operation of the drive to limit current to a desired value. The bias or current-limit reference voltage may be made adjustable to provide a range of current values over which limiting takes place. In a Ward-Leonard system, armature current may reverse during deceleration or with overhauling load. A reverse-current limit circuit incorporated in such a drive will limit current pumped back into the line.

B. Definite time control

Definite time acceleration or deceleration circuits provide another widely used technique for control. This method uses the charging characteristic of an R-C (resistance-capacitance) circuit to provide a definite acceleration or deceleration time. Unlike current limit, this circuit does not feed a signal to take over from the standard reference signal. Instead, it is used simply to modify the reference signal from the operator's control potentiometer, so that regardless of how rapidly the potentiometer is turned, the modified reference signal will increase or

TABLE 1 **DRIVE CLASSIFICATION**

TYPE OF DC ELECTRICAL DRIVE	MAX HP	AVAILABLE IN UNREG.	AVAILABLE IN GENERAL PURPOSE	AVAILABLE IN HIGH PERF.	CAPABLE OF REGEN.
1. Ward-Leonard					
Unregulated	600	2	X	X	Yes
With Electronic or	&UP				
Transistor preamplifier			X	X	Yes
2. Amplidyne	25		X		Yes
Amplidyne with preamplifier	25		X	X	Yes
3. All Electronic					
Thyratron	40		X	X	No
Ignitron	600		X	X	No
Excitron	100		X	X	No
4. Magnetic amplifier	100		X	X	No
Magnetic amplifier with preamplifier	100		X	X	No



Position synchronized system with provision for position adjustment

decrease at a definite rate. This rate is easily varied by adjusting the value of the resistance.

The simplest R-C circuit has an exponential charging and discharging characteristic. Also, this circuit requires large values of R and C to produce any sizable charging times. The resultant high-impedance circuit is often incompatible with the usual requirement for a "stiff" or low impedance reference. Various refined circuits are available to provide linear timing rates with moderate values of capacitance and which present the drive input with a stiff reference.

A small split-series field motor coupled to the reference potentiometer comprises another control of acceleration or deceleration. Push buttons in series with the fields are controlled by the operator to turn the speed potentiometer in one direction or the other, with the resulting rate of change in drive speed set by the speed of the motor.

EVALUATION OF THESE TECHNIQUES

1. To protect the drive elements

Because power rectifiers are not available in the same number of ratings as dc motors, a given control may be used to supply a number of motor horsepower sizes. Therefore, the control may be supplying current well within its rating, but high enough to seriously overheat the motor if frequent or prolonged acceleration of high inertia loads is called for. Current limit protects the motor and control by positive clamping of armature current.

Definite time control indirectly protects the drive by holding the rate at which the controlled reference can call for acceleration to a low enough value so that armature current needs no limiting. Direct protection for the drive elements in the form of fusing, and overload relays, obviates the need for current limiting, but is not readily adjustable for varying load conditions as are the previous methods. Because such direct protection is selected for the maximum permissible current values of the control or motor, the flexibility gained either by current limit or definite time control is not available.

2. To protect the driven load

Sudden torque transmitted to the driven load by rapidly increasing armature current in the drive motor often requires serious consideration when a drive is selected. This effect is especially severe when torque to the driven load is transmitted through a gear, belt, or a chain. Rapid takeup of slack in the coupling device delivers an impact load to the driven machine.

A high value of torque available from the control for accelerating purposes may also impose severe mechanical stresses in the driven load by a too-rapid acceleration rate. Similarly, too high an acceptance rate for absorbing pumpback armature current by the control may produce detrimental deceleration rates.

As with the protection of drive elements, both current limit and definite time control can minimize or eliminate the undesirable situations listed above.

3. For definite time control required by the process

Many material-handling operations require adjustable acceleration and deceleration rates to provide optimum efficiency of both the equipment and the operator. For many of these requirements, only definite time control is effective as this method will produce uniform acceleration or deceleration rates regardless of the amount of inertia and friction present in the load. By contrast, a drive with current limit would accelerate a reeler with an empty roll and low friction at a rapid rate while with a full roll it would be accelerated slowly for the same command from the operator or programmer.

DRIVE SYNCHRONIZATION

It is frequently desirable to coordinate the operation of the several sections involved in a continuous flow process. Certain conveyor drives such as refrigerator or lightbulb assembly lines require exact position co-ordination so that the item being carried will arrive at a particular destination at precisely the correct time for proper co-ordination with another step in the process.

For close-speed co-ordination, most of the previous discussion of accurate steady-state speed regulation applies too, because an essential condition for close-speed co-ordination is the accurate speed control of the individual section speeds. An additional requirement is the close matching of individual drive speeds over the entire operating range. That is, the same relationship must ordinarily exist between speeds from

the lowest speed to the top speed. This is called "tracking."

Essential for good tracking accuracy is a linear relationship for each section between the reference quantity, usually a voltage, and speed. This is necessary because in coordinated drives, the reference voltage will ordinarily be common to all sections. Thus, if each section is linear, it is merely necessary to provide adjustments to secure speed correspondence at the low and high end of the range to assure speed correspondence at all speeds in between.

TABLE 2

PERFORMANCE CHARACTERISTICS	DRIVE PERFORMANCE: GENERAL PURPOSE UNREGULATED DRIVE	GENERAL PURPOSE REGULATED DRIVE	HIGH PERFORMANCE REGULATED DRIVE
Speed range	5 to 1	50 to 1	100 to 1
Steady state regulation	5% to 30%	1% to 2%	1/10% to ½%
Steady state drift	5% per hr	1% per hr	1/10% per 8 hr
Response-maximum transient error	10%	5%	Less than 2%
Response-settling time	10 sec	5 sec	Less than 2 sec
Acceleration and deceleration	Can be adjusted	Easily adjustable	Easily adjustable over wide ranges

DRAW ADJUSTMENT

Related to the requirement of close speed correspondence are the "draw" adjustments between successive sections of a continuous-flow process. The usual draw condition is a constant stretch in the material being processed regardless of operating speed. Thus the drive requirements call for adjacent drives to produce surface speeds which are proportional at all speeds but for which the constant of proportionality is not unity (one). Draw at all speeds is ordinarily specified as a percentage, which means that the following section always operates faster than the preceding section by that percentage. To achieve this result, low speed adjustments are again required for both drives. Top speed adjustments are also required, with the exception that one is normally mounted externally and called "draw adjustment."

Automated assembly lines and similar applications often require exact synchronization between sections. The relationship between the positions of the driven machines must be maintained constant, and frequently this relationship must be adjustable. To achieve this result, the same general approach must be taken as for those drives whose speed relationship is to be controlled with the exception that additional modifying circuitry must be added to obtain position matching.

To maintain position, it is obviously necessary to add elements capable of detecting position and to provide a signal device, such as a "selsyn" or "synchro," to relay position information.

To achieve position synchronism between two drives, the drives may be arranged to obtain their reference signals from a common speed-control potentiometer with each drive operating in the tachometer feedback mode. This means that each motor mounts a feedback tachometer and that the drives will thus operate in close speed correspondence. To obtain position matching, a corrective signal proportional to position error between the motors is added to the control for one or the other of the motors. This corrective signal is obtained by mounting a selsyn generator on the shaft of one motor, a selsyn control transformer on the shaft of the other motor and a discriminator unit which, obtaining a signal from the selsyn control transformer, is capable of producing a dc output voltage which is proportional both to the direction and magnitude of the position error.

With the addition of this signal, the relative positions of the two motors is maintained constant.

Adjustment of the relative positions can be obtained, when required, by interposing a differential selsyn between the two motor-mounted selsyns. Another method of achieving relative position adjustment is to add an adjustable voltage signal in series with the dc reference voltage for one of the motor controls.

SPECIAL PROGRAMMING

An illustration of input programming is the constant-cutting-speed principle, familiar to builders and users of machine tools. In a vertical boring mill, for instance, the table or spindle drive rotates the work under a tool which is fed across the work as it cuts. If the table is driven at a constant speed, the surface speed of the table moving past the tool changes as the tool moves across the diameter of the work. By incorporating a potentiometer which senses the work diameter at which the tool is cutting at each instant, a signal from this potentiometer is programmed into the regulator to vary table speed in a hyperbolic pattern and keep surface cutting speed constant. Thus, uniformity of the finished product is improved and operating time is reduced. Other special programming utilizes signals from photoelectric loop equipment, mechanically driven cams, and solenoid reactors.

PERFORMANCE SUMMARY

For purposes of comparison, dc adjustable speed drives may be classified according to the degree of control associated with them. Three general categories used in tables 1 & 2 include unregulated, general-purpose, regulated, and high-performance regulated drives.

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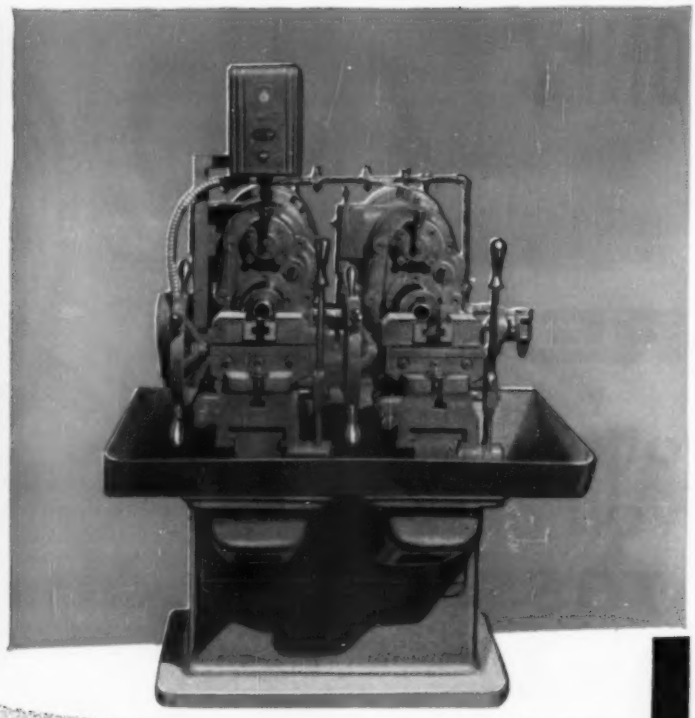

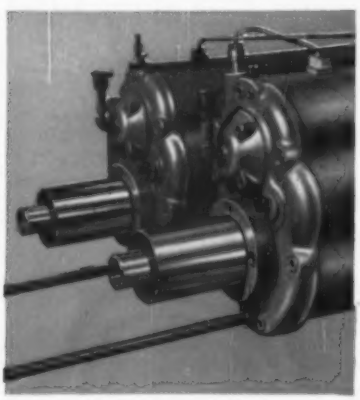

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American Machinist
REFERENCE BOOK SHEET

Geometric and Positional Tolerancing—VII

WALTER H HARRINGTON, engineering standards coordinator,
Avco Research and Advanced Development Div, AVCO MFG CORP, LAWRENCE, MASS

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When parts are machined on centers and the centers retained on the finished part, inspection can be on the same axis on which the part was machined, with the original axis as the datum. With the centers in place, each surface can be inspected by suitable instruments to determine the total indicator reading. However, if inspection must be made after the centers are removed, then surfaces already inspected for size must be used as datum surfaces. The part must then be mounted to check all surfaces, including the datum surfaces, to the limits specified.

"Within total indicator reading" means that the dial hand may move clockwise, counter-clockwies or partially in either direction from the starting point, but the total movement must be within the limit specified. Fig. 22A illustrates total indicator reading of a 0.005-in. limit.

All geometric tolerances stated in symbols are total tolerances, not plus-or-minus values. The tolerance is specified in terms of the maximum total indicator reading from true concentricity (Fig. 23). All notations in Fig. 24 are interpreted in the same way.

In spite of these various terms used to describe geometric tolerances, it often happens that one type of geometric tolerance will automatically limit other types of geometric error. Two examples of the effects of combined geometric tolerances, or overlapping tolerances, are:

1. Squareness tolerance, requiring a surface to be contained within a tolerance zone bounded by two planes the distance apart of the tolernace and perpendicular to the datum, limits the errors of flatness as well as those of squareness.

2. Parallelism tolerance, requiring elements of a surface to be contained within a tolerance zone parallel to the axis, limits the errors of straightness as well as those of parallelism.

FIG. 22A -TOTAL INDICATOR READING

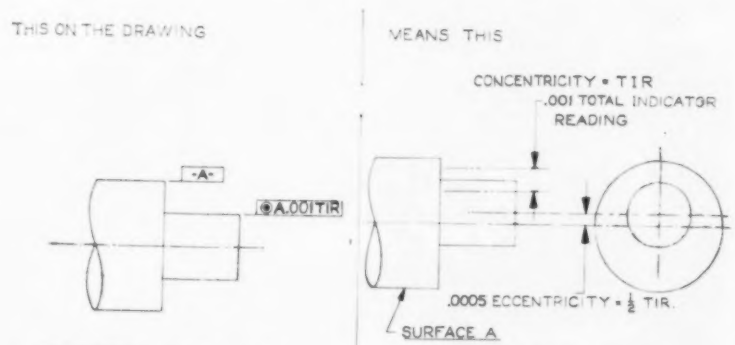

THIS ON THE DRAWING
MEANS THIS
-A-
⌖.001 TIR
CONCENTRICITY • TIR
.001 TOTAL INDICATOR READING
.0005 ECCENTRICITY • ½ TIR.
SURFACE A
CONCENTRIC WITHIN .001 TOTAL INDICATOR READING IN RELATION TO SURFACE "A"
WHEN THE PART IS MOUNTED ON SURFACE "A" THE OTHER SURFACE MUST BE WITHIN THE TOTAL INDICATOR READING SPECIFIED.

FIG. 23

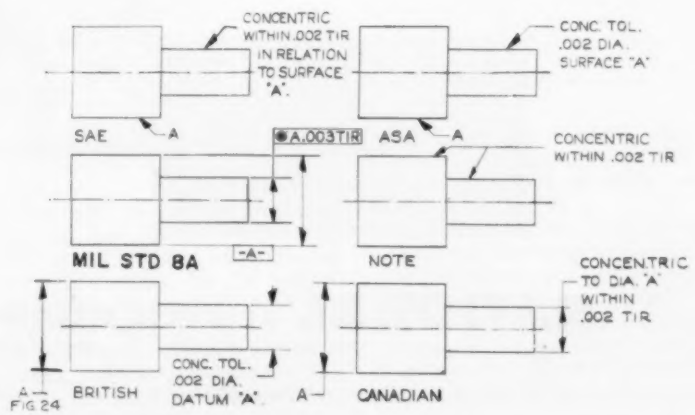


FIG. 24

NATIONAL ELECTRIC

solves tough production problem of welding air-suspension brackets for 1958 cars

The new air suspension systems introduced on some 1958 cars, create not only a super-smooth ride for passengers . . . but many production problems for manufacturers. To help lick one of these problems . . . National Electric designed and built two new multi-station arc welders that perform 2 important operations on the structural members of the new systems.

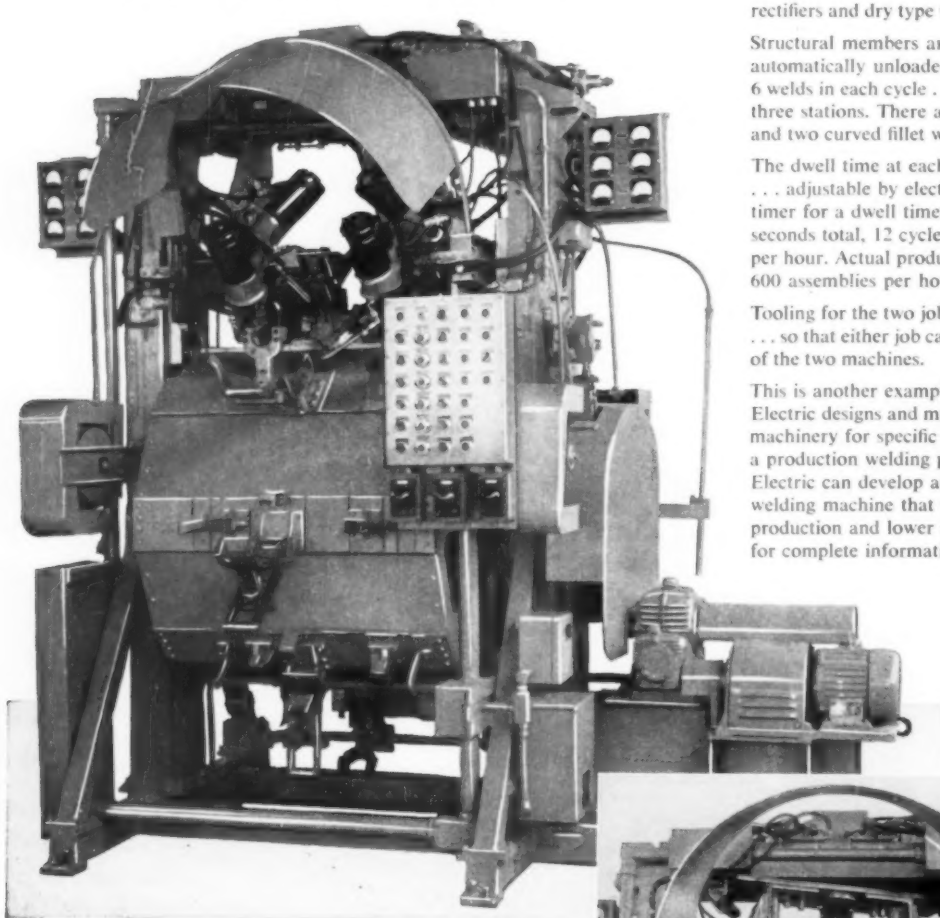
These 6-head, CO_2 arc welders incorporate a drum feed, 8-station Geneva Index, with 800 amp. rectifiers and dry type torches.

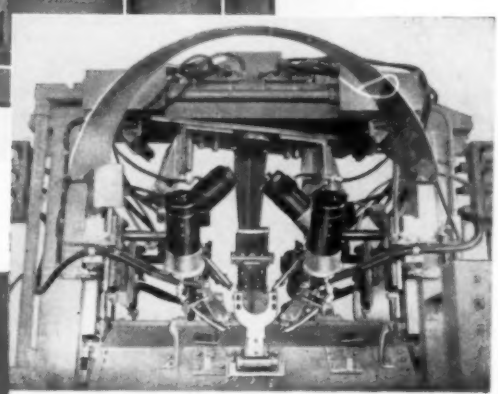
Structural members are manually clamped and automatically unloaded. The machines complete 6 welds in each cycle . . . two at each of three stations. There are four spot welds . . . and two curved fillet welds each two inches long.

The dwell time at each index is 1⅞ seconds . . . adjustable by electric clutch brake and timer for a dwell time of 3⅛ seconds, five seconds total, 12 cycles per minute or 720 cycles per hour. Actual production is approximately 600 assemblies per hour.

Tooling for the two jobs is interchangeable . . . so that either job can be run on either of the two machines.

This is another example of how National Electric designs and manufactures welding machinery for specific applications. If you have a production welding problem . . . National Electric can develop an automatic welding machine that will assure higher production and lower cost per weld. Write for complete information.





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REFERENCE BOOK SHEET

Extended-Center Helical Gears—I

CHARLES TIPLITZ, chief engineer CHALON, CONSULTING ENGINEERS, CEDAR GROVE, N J

Methods for calculation of pin dimensions for standard spur and helical gears have been presented in many books and magazines. However, in some applications, extended-center helical gears are in use, such as in roll mills for paint and ink, and in feeding devices for round or flat stock not of constant diameter or thickness. Inspection of these gears with pins is complicated by computations. Accordingly, a systematical method based on the traditional formula* and a step-by-step form (page 111) was developed.

Equations 1 and 2 relate cutting data to backlash of a gear set. Equations 3 and 4 convert normal angles to angles in the plane of rotation. The other equations determine the measurements across pins. Equation 2 can be simplified, first by recognizing that for standard hobs, tooth thickness at the pitch radius equals half the circular pitch, i.e., $2t = p$. Then since $p \cos \phi = p_b$, equation (2) reduces to equation (9).

The first term on the right-hand side can be reduced further by substituting $\cos \phi \tan \phi$ for $\sin \phi$:

$$\frac{p_b\ (N_a + N_b)}{2\ \pi\ \cos \phi} \left[\frac{\text{inv } \phi_r - \text{inv } \phi}{\tan \phi} \right]$$

Now $p_b \div \cos \phi = C_p$ (circular pitch), and $C_p\ (N_a + N_b)$ = total circumference of both gears, for standard pitch gears. Total circumference $\div 2\pi$ = total radii or center distance for standard pitch gears at tight mesh (zero clearance) and let this equal C_z. Then long addendum is given by equation (10).

The basic formulas are:

(1) $t_c = t + 2\ \Delta \tan \phi$

(2) $\Delta_a + \Delta_b = \dfrac{p_b - 2t \cos \phi - b \cos \phi_r}{2 \sin \phi} + \dfrac{p_b\ (N_a + N_b)\ (\text{inv } \phi_r - \text{inv } \phi)}{2\ \pi \sin \phi}$

(3) $\sin \psi_B = \sin \psi \cos \phi_n$ (4) $\tan \phi \cos \psi = \tan \phi_n$

(5) $\text{inv } \phi_p = \dfrac{t_c}{2r} - \dfrac{\pi}{N} + \text{inv } \phi + \dfrac{W}{r_B \cos \psi_B}$

(6) $r_p = \dfrac{r \cos \phi}{\cos \phi_p}$ (7) $M_{even} = 2(r_p + W)$

(8) $M_{odd} = 2\left(r_p \cos \dfrac{90^\circ}{N} + W\right)$

(9) $\Delta_a + \Delta_b = \dfrac{p_b\ (N_a + N_b)\ (\text{inv } \phi_r - \text{inv } \phi)}{2\pi \sin \phi} - \dfrac{b \cos \phi_r}{2 \sin \phi}$.

(10) $\Delta_a + \Delta_b = C_z \left[\dfrac{\text{inv } \phi_r - \text{inv } \phi}{\tan \phi} \right] - \dfrac{b \cos \phi_r}{2 \sin \phi}$.

Where:

- t_c = actual tooth thickness at standard pitch
- t = standard thickness at standard pitch
- Δ = amount cutter is moved out from its standard position
- ϕ = pressure angle in plane of rotation at standard pitch circle
- Δ_a = amount cutter is moved out from standard position to cut gear a
- p_b = circular pitch at base circle
- b = backlash at meshing pitch circle
- ϕ_r = pressure angle in plane of rotation at meshing pitch
- ψ_B = helix angle at base circle
- ψ = helix angle of hob setting
- ϕ_n = pressure angle of hob
- ϕ_p = pressure angle of measuring roll or pin
- r = radius of standard pitch circle
- W = radius of measuring pin
- r_B = radius of base circle
- r_p = distance from gear center to measuring pin center
- M = measurement across outside of rolls or pins

The listing of formulas may not be adequate because 2 hr may be required for a single solution. Time-study has showed that substantial time was lost referring to the equations and determining successive steps. To get around this, a list of necessary steps was prepared. The list is self contained, except for mathematical tables, and thus eliminates the time each person need spend to set up his own procedure. Checking is simplified, likewise adaptability to digital computer programming.

Use of the form will reduce computing time to 30 min. or less. The right-hand column shows the number of decimal places required in each step to obtain 3-place accuracy for gears between 3 and 30 in. Other requirements can be scaled up or down.

*Manual of Gear Design, Sections I-III. Industrial Press, 1935-7, and Analytic Mechanics of Gears, McGraw-Hill, 1949—both by Earle Buckingham; and Involute Gears, by W. Steeds, Longmans Green & Co, 1948.

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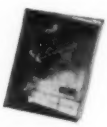

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Extended-Center Helical Gears—II

Tabulation of Cutting and Pin Calculations

STEP	Description or Source	Gear *a*	Gear *b*	Dec. Places
1	N, Number of teeth	— — — —	— — — —	—
2	D_p, Diametral pitch			5
3	ϕ_n, Hob pressure angle (normal)			3
4	ψ, Helix angle, hob			3
5	cos Step 4 (std table)			5
6	tan Step 3 (std table)			5
7	Step 6 ÷ Step 5 = tan ϕ (equat. 4)			5
8	ϕ, pressure angle at standard pitch in rotation plane (std table)			3
9	cos Step 8 (cos ϕ)			5
10	Step 2 × Step 5 (D_p cos ψ)			5
11	Step 1 ÷ Step 10 = standard diameter = D	— — — —	— — — —	4
12	Step 11 ÷ 2 = standard pitch radius = R	— — — —	— — — —	4
13	Step 12, Col. *a* + Step 12, Col. *b* = standard gear center = C_1			4
14	Step 11 × Step 9 = base circle diameter = D_B	— — — —	— — — —	4
15	Step 14 ÷ 2 = base circle radius = R_B = R cos ϕ	— — — —	— — — —	4
16	Step 15, Col. *a* + Step 15, Col. *b* = total base circle radii			4
17	Required centers = C_2			4
18	Step 16 ÷ Step 17 = cos ϕ_r			5
19	ϕ_r, actual or mesh angle (std table)			3
20	involute Step 19, inv ϕ_r (std table)			6
21	inv Step 8, inv ϕ (std table)			6
22	Step 20 − Step 21			6
23	Step 22 ÷ Step 7			5
24	Step 23 × Step 13 = $C_1\left[\frac{\text{inv } \phi_r - \text{inv } \phi}{\tan \phi}\right]$			4
25	sin Step 8, sin ϕ (std table)			5
26	Step 25 × 2 = 2 sin ϕ			5
27	b, backlash at meshing pitch circle			4
28	Step 18 × Step 27 = b cos ϕ_r			4
29	Step 28 ÷ Step 26 = $\frac{b \cos \phi_r}{2 \sin \phi}$			4
30	Step 24 − Step 29 = $\Delta_a + \Delta_b$ (equat. 10)	— — — —	— — — —	4
31	Δ_a & Δ_b, amount of long addendum			4
32	1 ÷ Step 2, standard addendum	— — — —	— — — —	4
33	Step 31 + Step 32, actual addendum	— — — —	— — — —	4
34	Step 33 × 2	— — — —	— — — —	3
35	Step 34 + Step 11, actual OD			4
36	$\pi \div 2$			4
37	Step 36 ÷ Step 10 = t, std tooth thickness at R			5
38	2 × Step 7 = 2 tan ϕ	— — — —	— — — —	4
39	Step 38 × Step 31 = 2 Δ_1 tan ϕ, extra tooth thick.	— — — —	— — — —	4
40	Step 39 + Step 37 = t_r, actual tooth thick. (equat. 1)	— — — —	— — — —	6
41	Step 40 ÷ Step 11 = $t_r/2R$	— — — —	— — — —	6
42	$\pi \div$ Step 1 = π/N			5
43	cos Step 3 (std table)			5
44	sin Step 4 (std table)			5
45	Step 43 × Step 44 = sin ψ_B (equat. 3)			2
46	ψ_B, helix angle at base, R_B (std table)			5
47	cos Step 46 (std table)			5
48	Step 14 × Step 47 = D_B cos ψ_B	— — — —	— — — —	4
49	1.728 ÷ Step 2 = 2W = Pin or roll diameter	— — — —	— — — —	6
50	Step 49 ÷ Step 48 = $\frac{W}{R_B \cos \psi_B}$	— — — —	— — — —	6
51	Step 41 + Step 21 + Step 50 − Step 42 = inv ϕ_p (equat. 5)	— — — —	— — — —	2
52	ϕ_p, pressure angle of pin (std table)	— — — —	— — — —	5
53	cos Step 52, cos ϕ_p (std table)	— — — —	— — — —	4
54	Step 14 ÷ Step 53 = $2r_p$ (equat. 6)	— — — —	— — — —	—
55	If Step 1 is even write Step 54 in Step 58 and skip to Step 59	— — — —	— — — —	2
56	If Step 1 is odd: 90° ÷ Step 1	— — — —	— — — —	5
57	cos Step 56 (std table)	— — — —	— — — —	4
58	Step 54 × Step 57 (If Step 1 is odd = 2 r_p cos $\frac{90^\circ}{N}$	— — — —	— — — —	3
59	Step 58 + Step 49 = M, across roll or pins (equat. 7 or 8)	— — — —	— — — —	3
60	2.157 ÷ Step 2, standard cutter depth	— — — —	— — — —	

NOTES:

1. Subscript *a* or *b* refers to value in column for step number for gear *a* or gear *b*, respectively.

2. Data in steps 1 to 4, 17, 27 and 31*a* or 31*b* must be supplied for each problem as base or design data.

3. (std table) refers to values obtained from standard tables for trigonometric or involute functions.

4. Dash lines in columns for Gear *a* and Gear *b* indicate that data must be entered for both gears. Where no dash lines are given, a single entry will suffice.

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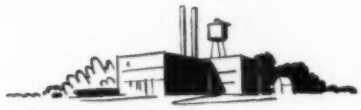


Talking Shop...

Code Confusion

WHEN CURTISS-WRIGHT built a new plant in the San Fernando valley in California, electrical inspectors red-tagged an assortment of 200 brand new machine tools for internal wiring that violated the city code. The Van Nuys Chamber of Commerce, knowing an emergency when it saw one, arranged help in correcting the "deficiencies" so the plant could open, and helped in getting a meeting of the machine tool builders involved and the City of Los Angeles that has led to compromises: the city no longer red tags a lot of minor differences and the builders have altered wiring in other respects to comply with the Los Angeles code.

Gossip, Modified

THE CHILDREN'S GAME of gossip was used as the basis for a graphic demonstration at the last AGMA meeting of the problem you have in getting the facts you need to make a decision. A simple situation was described by Edward Walther to a volunteer, who then repeated it to another. The information passed through five sets of ears and mouths in a typical chain from salesman or foreman to president. When the audience heard the situation as reported by the last man the "facts" bore only a superficial resemblance to what had been presented to the first man in the chain. Suppose, further, that more time had elapsed between repetitions, as would be the case in the normal business situation. Make sure you have the facts straight before you act!

Conference Television

INSTITUTE OF RADIO ENGINEERS' Production Conference, last month, put closed-circuit television to good use by introducing a kind of "commercial" spot. Sandwiched between paper presentations in the Hotel New Yorker ballroom, GPL cameras and a projection viewer showed short demonstrations at exhibitors booths several rooms away. Audio was tied in so company representatives could add comments—not in the most expert broadcasting style, but good enough. One speaker used the system functionally during his talk to show samples and indicate features of miniaturized equipment. No report reached us on how many engineers in the audience got up and headed for the refrigerator when the commercials came on.

Without Honor

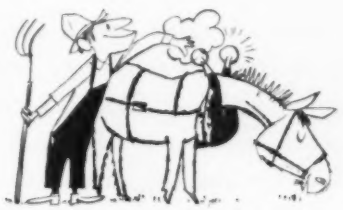
FOR THE RECENT Hanover Fair, a local restaurant wanted to offer Chinese food in an authentic atmosphere. The proprietor searched the Far East for the exact pots and pans he needed, finally found them in Hongkong. After much red tape he arranged to import them. When the shipment finally arrived in Hanover and was unpacked, each metal implement bore the imprint "Made in Germany."

Wooden Chuck

A THIN COLD-DRAWN steel cup with a flange at the outer rim is faced and chamfered at 2238 sfpm at Davis-Martin Engineering in Los Angeles. The biggest problem was to hold the work so it would not be marred or distorted in the process. Solution was to turn a wooden nest in which the blank could fit, then bolt the wooden fixture to the lathe faceplate. The work is placed in the nest and held by a hydraulic ram in the tailstock. In this position the flange is exposed for facing and chamfering. Two Kennametal K7H tools perform the two operations in one pass with a hand feed of 0.009 ipr and a maximum depth of cut of 0.020 in. At 2238 sfpm in a 12-in. Atlas-Clausing lathe, the operation takes 10 sec. Because of the unusual drive method, the tools are indexed every 100 pieces, to minimize tool pressure.

MEMOS

by BESS RITTER



Superstitious people in many parts of the world have believed —and still believe—that brass will protect them from the spirits of evil. Thousands of years ago the Chinese were so sure of this that they manufactured special brass instruments to make noises which were believed to be especially terrifying to devils and their like—and to this very day, in many sections, brass gongs play an important part in their rites of exorcism.

Not so long ago the Japanese practiced a different type of brassy superstition: Before an undertaker would place a corpse in its coffin, he would receive a simple brass bracelet from one of the next of kin. The man immediately placed it on his right arm, and kept it there until the body was entered in its grave. For unless he did, it was surely believed, the spirit of the dead person would be able to do him harm.

The English haven't been immune to similar superstitions, which have been handed down to them from the customs of the early British and the Saxons, and one way in which this was expressed persisted until the advent of modern farm machinery.

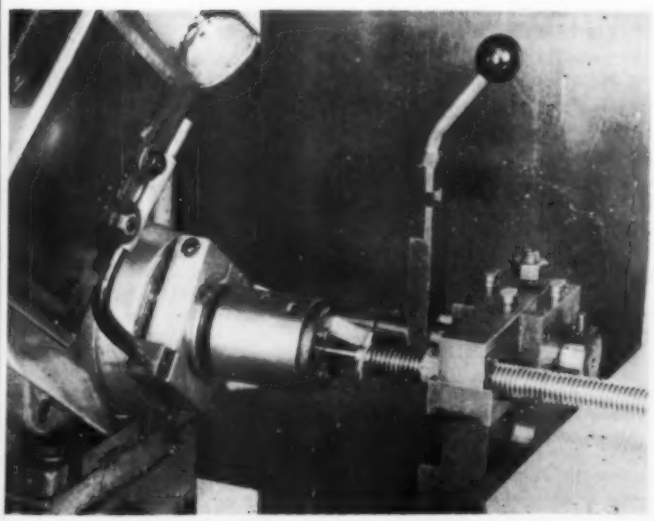
It was always the custom to hang bright brass ornaments on the harnesses of farm horses. This was important in order to protect such animals (on which the economy of the farm depended to a great extent) from the evil eye, witches, and other assorted figments of the British superstitions. Such metal was always kept bright with elbow grease and polish, even though the equine wearer was unbrushed, uncurried, and the harness which supported the metallic array was bedraggled, shabby, and in need of mending.

special machines solve

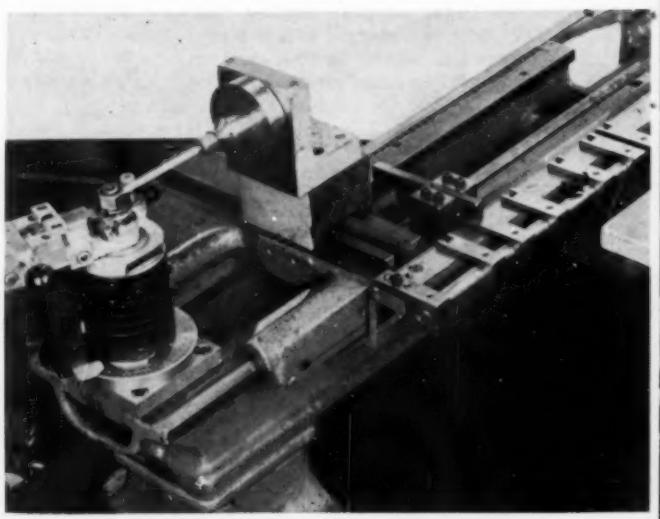
A case of the bends

MICHAEL W MALONEY,
Supt of Aircraft Assembly, WALTER KIDDE & CO, BELLEVILLE, N J

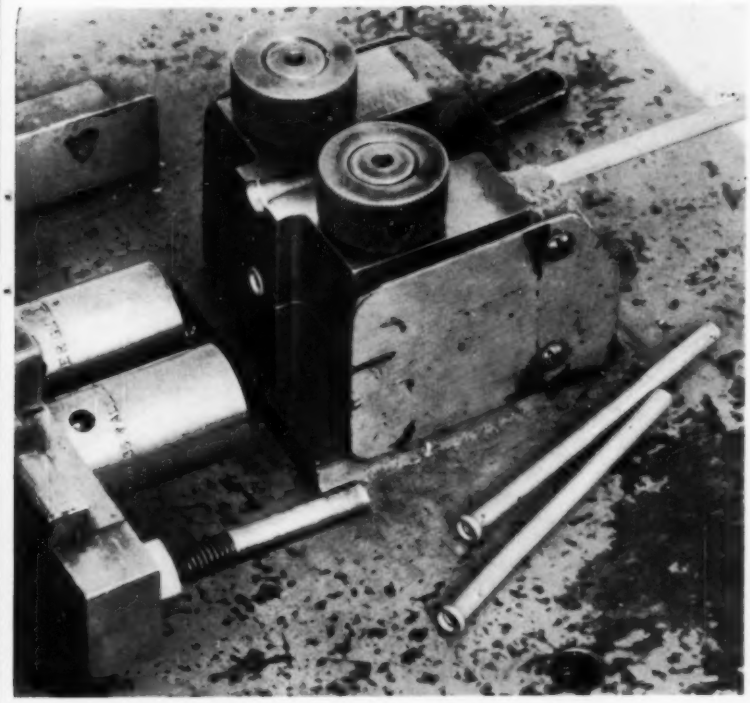
Aluminum, stainless-steel, and copper tubing for aircraft pneumatic systems is formed and bent by special equipment, including two shop-built machines. Both plain and finned tubing, designed to operate at 4500 psi, are formed for Kidde equipment and for outside contract customers



Definning machine . . .
is operated by Delta power head that rotates single-point tool. Tubing is locked in special replaceable bored jaws that grip all around fins. Cutter trepans around tube OD to smooth tube end so it can be flared



Special Kidde-built bender . . .
was assembled with a bench-lathe bed and fitted with adjustable notched stops that space off distances between bends on the tubing. Chuck on carriage holds one end of tube with a center to which a tube fitting is threaded. Tube is bent around post, gaged by graduated collar at bottom, and prevented from bowing by nylon roller (visible to right of post top nut)



Vail machine does single or double flaring . . .
If double, flaring head indexes to one side to bring in second flaring tool. Precision switch controls length of air-cylinder stroke. Flaring dies and tube-gripping jaws are all replaceable

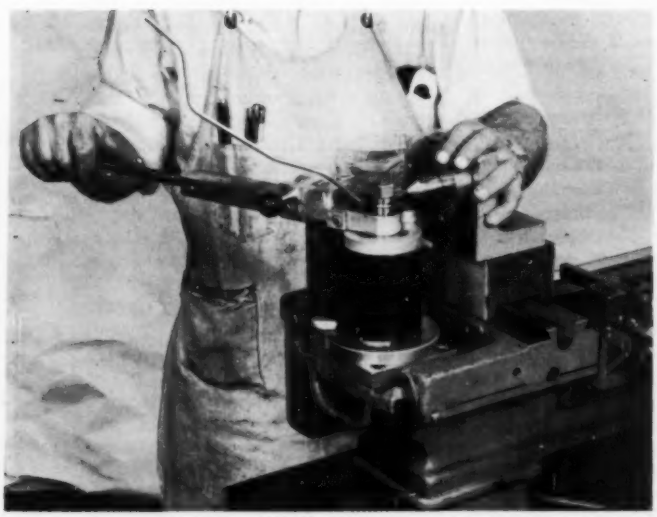
Springback rates . . .
for various bends in stainless steel and aluminum have been charted so bender can be set up accurately

SPRINGBACK ALLOWANCES

for Tubing

(0.035 in. wall)

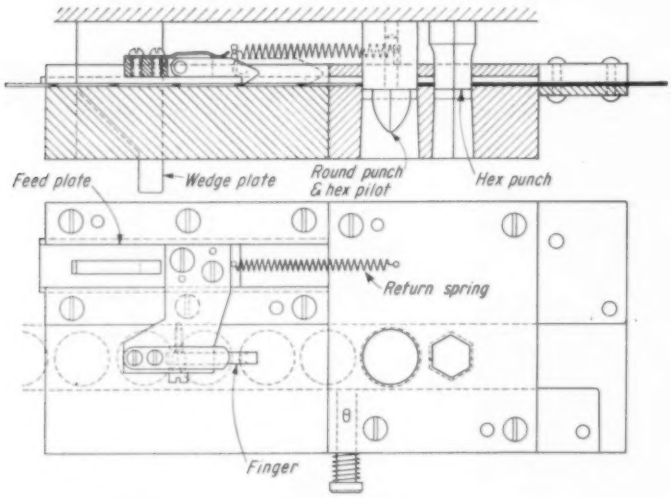
Angle of Bend	0.250 O.D. Tubing 9/16 in. Radii Degrees		0.3125 O.D. Tubing 11/16 in. Radii Degrees		0.375 O.D. Tubing 15/16 in. Radii Degrees	
	Al	St	Al	St	Al	St
10°	2°	2°	2°	2°	1°	2°
20°	2	3	2	2	2	3
30°	2	3	2	3	2	3
40°	3	4	2	3	2	4
50°	3	4	3	4	2	4
60°	4	5	3	4	3	5
70°	4	5	4	5	3	5
80°	5	5	4	5	4	6
90°	5	6	5	5	4	6
100°	5	6	5	6	5	6
110°	5	7	5	6	5	6
120°	5	7	5	7	6	6
130°	5	7	5	7	6	6
140°	4	7	6	8	6	7
150°	4	8	6	8	7	8
160°	4	8	6	9	8	8
170°	4	9	6	9	8	9
180°	4	10	6	10	9	10



Bending post is lever-operated . . .
but may be controlled by five adjustable cam plates on post spindle. A pin is inserted in horizontal holes in vertical bar under bending arm so it will stop against shoulders of cam plates to limit bends. Tubes of different size are bent after threaded center, mandrel collar, and wiping shoe are changed. Adjustments in cam-plate locations are made with hex wrenches

Finned tubes are bent . . .
on hardwood forms that are machined and sanded to shapes that include springback allowances. Hand bending is necessary because a machine would collapse the fins

Practical Ideas...



Simple Wedge Mechanism Feeds Progressive Die

This feeder was built to move strip stock through a progressive die that cuts round washers with hex center holes. It operates from a wedge plate in the ram, which moves a feed plate on the die.

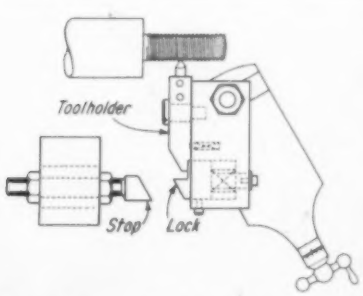
The wedge plate comes down with the ram, forcing the feed plate to the left as the wedge bears against one end of a slot in the feed plate. This pulls the feed finger against spring pressure to move the strip stock over into the next position where the pilot locates the work.

On the return stroke the spring pulls the feed plate back, allowing the feed finger to drop into the next pierced hole for the next cycle.

The feed plate is dovetailed under two auxiliary plates on top of the die so it will not pull up or get out of position any other way. End stops for the feed plate are not required because the wedge plate is always engaged in the slot. The feed finger drops into a pierced hole in the stock every time because it is hinged, and is spring-loaded.

Operation is entirely mechanical and fairly foolproof, and the feeder may be applied to many other similar die sets.

Hjalmar Dahl, Upplands Vasby, Sweden



Threading Attachment Releases Tool at Shoulder

This rig allows us to thread right up to a shoulder without danger of jamming the tool into the work. When it is adjusted properly, it is an automatic tool release.

The tool is held in a bar that pivots against the main toolblock on a heavy bolt. There is a detent ball—spring-loaded and held by rolled hole edges—but this is necessary only to help line up the toolbar when the tool is reset for a new cut. The bar and tool are actually held in position by a trigger-like lock at the back end of the toolblock.

This lock engages a notch at the rear of the toolbar. The lock is round stock, and is prevented from rotating by a setscrew through the rear of the toolblock. A spring behind the lock normally keeps it extended where it can engage the toolbar.

As the carriage approaches the lathe headstock, the slanted extension on the lock contacts a slanted face on a bed stop. These angles are the same as the thread being cut—and the same angle as set on the lathe compound. In most cases it is 29°.

Because of the angle, the stop does not have to be adjusted when a second cut is made on the same workpiece with the lathe slide advanced for a final cut. The slant compensates for tool advance, and stop adjustments are only required when a new workpiece is inserted in the lathe.

As the lock contacts the stop, it is pushed back against spring pressure to release the toolbar, which swings nose down to clear the work safely.

Ernest Jones, Bronx, N Y

Scales Simplify Machine Adjustments

We sometimes have to use our vertical milling machine to find accurate hole locations. Some means of checking table movements, besides direct reading of hand-wheel graduations, are then desirable. Counters mounted on the handwheels were tried unsatisfactorily. Too often the operation would accidentally jar the counter and we'd have to move back to a reference point and start all over.

This problem was inexpensively solved by mounting scales on the table for lateral and traverse movements. Accurate readings are still taken from the dials, but the scales give us a close-approximation reference.

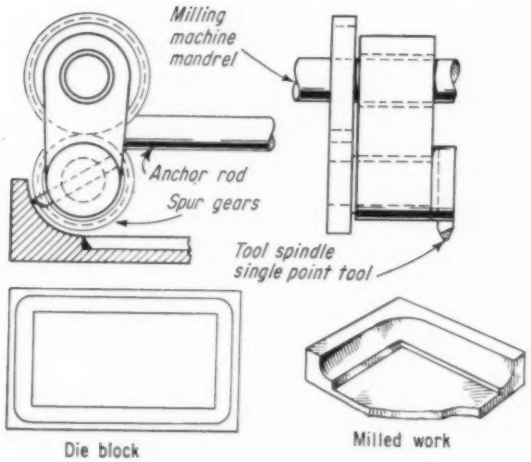
Precision scales are not necessary and a 27-in. length of flexible rule is adequate for our lateral table movement, while an 8-in. scale is employed on the traverse. Other machines will require correspondingly different scale lengths.

The long scale is fastened on the front side of the machine table; and a pointer with more than ½-in. side adjustment is mounted on the top of the housing for the table locking screw. The short scale is similarly mounted, the scale moving with the table and the pointer stationary.

Now when the initial reference surface has been zeroed out with the machine spindle, the machine dials are set on zero. The pointer is then set on the nearest inch mark and the operator can forget about counting each turn of the handwheel.

William De Groat, Altadena, Calif

Special Gear Head Produces Difficult Internal Radius



We recently received an order to machine a quantity of dies. Only one of the operations gave us any real trouble. That was the radius which had to be machined on the internal edge of the female half.

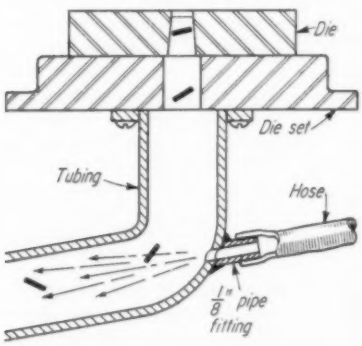
As the centerline of the radius was flush with the top edge of the die, it was impossible to use a cutter arbor in the usual way. Radius form cutters were ruled out because of the size of the radius.

The gear-head arrangement shown gave us the satisfactory solution to the problem. A bearing block was made and bored to a running fit on the arbor. Another bore was machined to receive an auxiliary tool spindle. The distance between the two bores was carefully laid out so a gear mounted on the miller spindle would properly mesh with a spur gear keyed to the tool spindle. Bushings were then fitted to both bores.

The auxiliary spindle was milled to accept a square toolbit which was used and adjusted in regular boring-bar fashion. A husky anchor rod located and supported the gear head at the desired angle.

Normal speeds and feeds were then followed in producing the straight-line radius in the cavity. Corners were blended with the sides with the aid of a rotary table.

M C Hussey, Westbury, Bristol, England



Suction Aids Slug Ejection

When notchings, shavings, or slugs are drawn back or are vibrated to the top surface of the die, trouble usually develops. This causes misfeeding, bent parts, or marked up parts.

One method of drawing these slugs down through the die is by vacuum. An inexpensive vacuum unit can be made using the venturi effect, as shown in the sketch, and attached to the underside of the die set.

Such a unit is made in either of two ways; one way is to use thin-wall tubing which is heated and bent as shown. Or pipe fittings can be assembled to form the body of the unit. A pair of pipe nipples joined by a 45° elbow will do fine.

In both cases, a ⅛-in. pipe fitting is drilled for and soldered to the body so when air is injected it is aimed at the lower opening. A flange is necessary for mounting if tubing is used. But the pipe nipple can be threaded directly into the die set if desired.

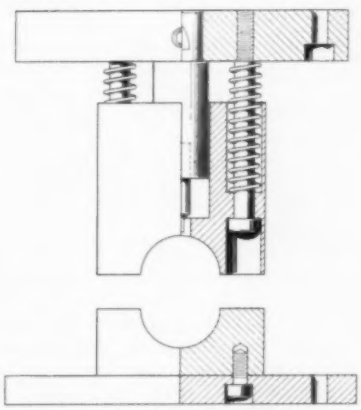
Raymond Pajer, Guest Manufacturing Co, New Haven, Conn

Low-Cost Die Pierces Pipe Wall

We had a large quantity of pipe lengths which had to have small holes pierced in a straight line. Drilling was first tried, but besides being slow, the drill would allow small hard-to-remove chips to enter the pipe. Solid slugs would be no problem.

The inexpensive die illustrated does a fast and efficient job without damage to the pipes by collapsing. One reason for the low-cost construction is that this die requires no die-set mounting. The die half is bolted directly to the bolster plate, while the punch plate is secured to the press ram.

The punch plate is made from a 1-in. plate and is center bored to accept the punch holder. A bore for the pipe is machined through the split line of two blocks, one about 3 in. high, and the other 2 in. This bore has only 0.007-in. clearance over the OD of the pipe. The lighter block is



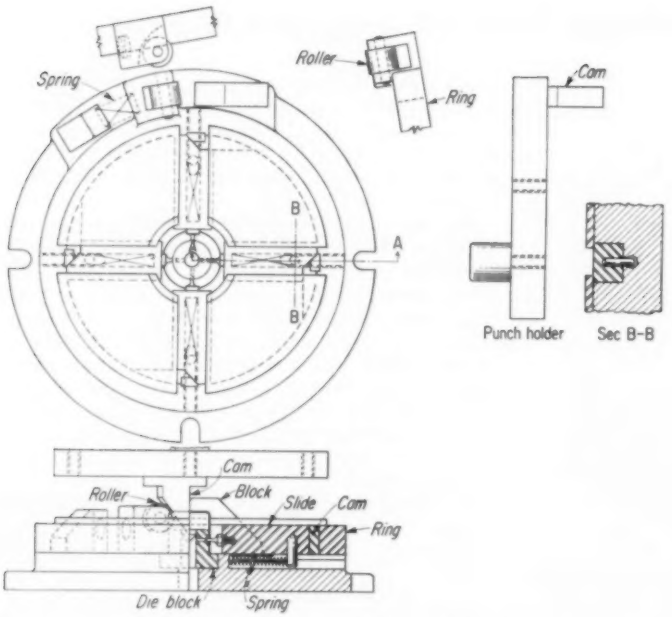
then bolted to a base plate.

A counterbore and a through hole are machined in the heavier block to clear the punch holder and punch. Four corner mounting holes are drilled and counterbored from both sides. The top side houses four springs, and the bottom side is for stripper-bolt head clearance. Spring loading the top block enables it to strip the work off the punch.

Various methods can be used in establishing index stops. One way is to bore a hole in a solid block at the same height as the radius of the die block. This block can then be conveniently bolted to the bolster plate.

Andre Farce, Giffard, Quebec, Canada

Practical Ideas...



Wedge Die Pierces Side Holes In Cups

Four holes around the OD of a small cupped piece in stock up to 16 gage can be pierced with a rotating wedge-action die. One wedge is attached to the upper die to rotate a ring in the lower die; the four smaller wedges in the ring advance the punches toward the center of the work.

It works this way: The ram comes down, carrying a cam mounted firmly on a punch holder that is bolted to the ram. The cam wedges between a fixed stop block on the die-set base and a roller mounted on a rotating ring. The roller works against spring pressure so it again returns to position when the ram rises.

As the ring is rotated, it operates four smaller cams that push slides in toward the work, which is mounted on top of a die block. The slides carry punches that pierce small holes in the cylindrical portion of the cupped workpiece. Springs return the slides to starting position when the ram rises.

The main cam is placed to the rear of the die set, which is a safety feature. Punches and cams can be replaced when they are worn. Die is loaded and unloaded by hand.

Alex W Knudsen, Rocky River, Ohio

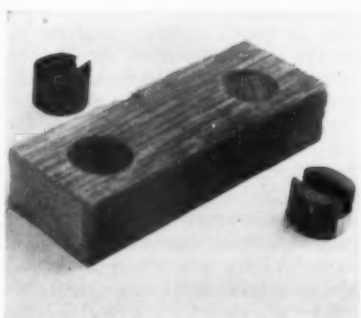
Magnets Hold Wooden Vise-Jaw Liners

Wooden vise-jaw inserts to hold soft parts or to protect fine finishes can be held to regular vise jaws with permanent magnets.

The wood pads are drilled blind to take button magnets with a push fit. This leaves the working surfaces of the wood without holes. The magnets are pressed into place so they are flush with the back sides of the wood pads.

After the wood has become damaged, it can be split to release the magnets for further applications.

H J Gerber, Stillwater, Okla



EDWIN H STOCK
St Louis, Mo

won $25 in addition to regular payment for his idea:

DIE PRODUCES PART WITHOUT STRESS

in the May 5, 1958 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

Our annual Production Planbook will reprint all winning ideas as a review. One will be chosen out of this issue as a winner of winners, and will receive a

GRAND PRIZE OF $100.

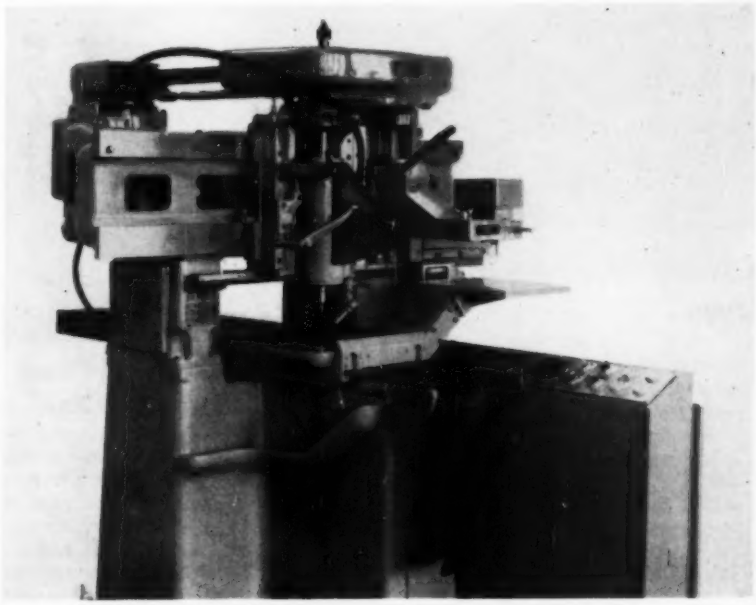
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.

New Shop Equipment
Materials and Parts



Automatic 360° Vertical Profiler Traces at Speeds up to 60 ipm

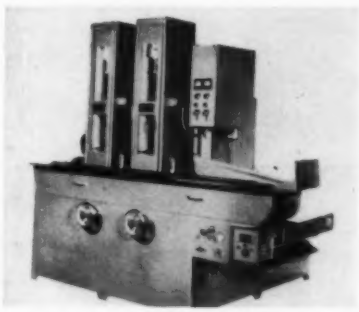
Incorporating spark-gap sensing elements, the Magnespark profiler operates from a sheet steel profile templet to produce any two-dimensional straight-line or irregular contour shape. Tracing speeds up to 60 ipm are possible and accuracy is reported to be better than that attainable with earlier profiling methods.

The machine's ability to trace at a preset constant surface speed assures better surface finish as well as longer cutting tool life.

Accuracy is attributed to extreme tracer sensitivity coupled with backlash-free drives to the table and spindle slide. The two spark-gap pickups in the tracing head are so sensitive that it takes only 0.0002-in. stylus deflection to activate the table and slide. Zero tracer pressure permits the use of soft steel templets. For quantity production, automatic cycling is available.

If desired, the company is prepared to furnish Magnespark machines already tooled for automatic production of specific parts.

Pratt & Whitney Co, Inc, West Hartford 1, Conn



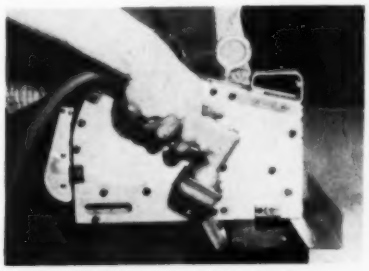
Multiple-Head Belt Grinder Speeds Grinding and Finishing

Model 696 multiple-head abrasive belt grinder permits two or more high speed grinding and finishing operations in the same time as formerly required for a single operation. Unmachined surfaces, ground on a series of progressively finer-grit belts, can be finished in one pass. Heavy stock removal can be accomplished by using a series of identical belts.

Machine is available with from two to six or more individually adjustable grinding heads. Maximum part size is 5½ in. wide by 6½ in. thick. The conveyor belt, which carries parts under the grinding heads, is powered by a 1½-hp variable speed motor, and is infinitely adjustable for feed rates from zero to 67 fpm.

Other features of this wet-or-dry belt model include pneumatic tensioning of both the conveyor and abrasive belts, rapid-traverse grinding heads, abrasive belt (6 x 96 in.) speed of 5400 sfpm. Machine drive is 7½ hp, 3600 rpm, with 10 or 15 hp optional. Over-all dimensions of the two-head model are 87 in. high, 110 in. long and 75 in. wide.

Engelberg, Inc, 831 W Fayette St, Syracuse 4, NY

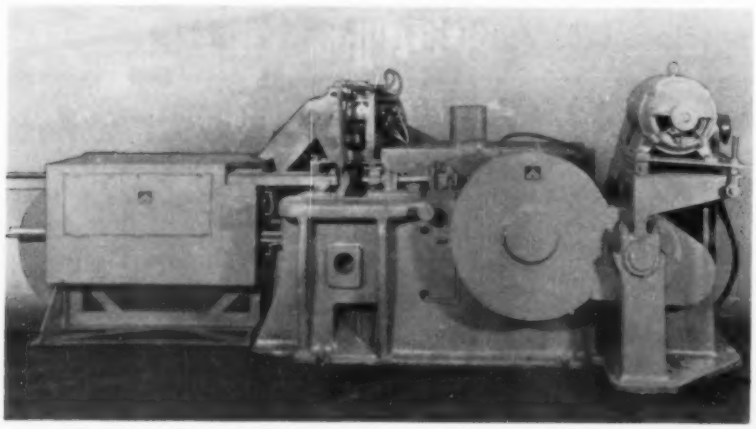


Portable Metal Stapler Performs Heavy-Duty Fastening Jobs

The Model P-10 portable metal stapler staples steel, copper, aluminum, rubber, plastics, fibers and similar materials, like-to-like or in combinations. It uses pre-formed staples of high tensile strength which are fully supported in an enclosed channel when being driven.

Machine is air operated and can be carried and operated in the hands, making it unnecessary to move heavy materials while they are being fastened. When fastening metals, the stapler handles a maximum combined thickness of approx 0.080 in. of steel, depending on hardness. In fastening other materials, the P-10 fastens up to ¼-in. total thickness, depending on the nature of the material. Full 360° rotation insures easy manipulation in difficult positions. Unit weighs 24 lb, requires air pressure of from 75 to 90 psi.

Bostitch, 2002 Briggs Drive, East Greenwich, RI



Hill Acme Introduces Line of Automatic Upset-Forging Machines

These automatic upset-forging machines willl be produced in the normal sizes of 1¼ in. to 5 in. for producing various products automatically. Material is pre-cut to length, heated, and fed into a receiving chute on the machine. These pieces are then gaged, picked up by the fingers, and passed progressively through the dies. While material is being moved from pass to pass it can be rotated 90° to assure a uniform forging. Short parts are allowed to drop through the bottom opening and long parts are ejected rearward from the machine.

A finished upset forging is produced with every revolution of the forger. This development does not limit the number of passes or the length of the stock used. The machine illustrated, the 1½-in.-size Model XN, produces ¾-in.-dia, square or hex-head bolts with a length of up to 24 in. at a rate of 60 bolts per min.

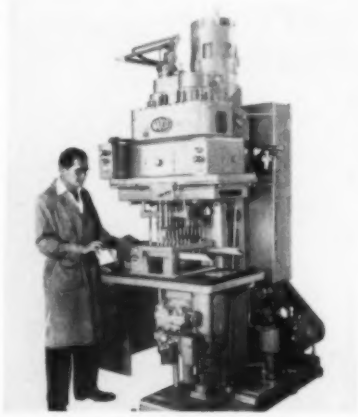
Hill Acme Co, 1201 W 65 St, Cleveland 2, Ohio

Platform Truck Can Carry Long Bar Stock or Pipe

Model F40, 4000-lb-capacity platform truck features a torque converter drive transmission. Truck is powered by an 18-hp, two-cylinder, air-cooled engine and features automotive-type steering, dual front wheels, heavy industrial drive wheels, and a spin-proof differential.

The flat bed is 42 in. wide and is 78 in. long behind the engine enclosure. The space at the right of the engine for handling long bar stock, pipe, lumber, etc, is 21 in. wide and 122 in. long.

Prime-Mover Co, Muscatine, Iowa

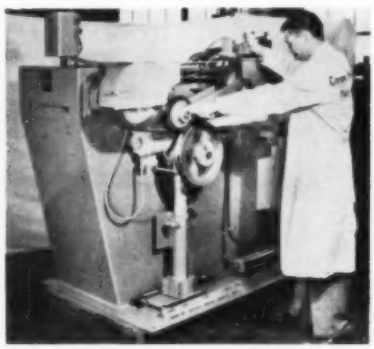


Multi-Spindle Machine Drills And Taps 400 Parts per hr

Designed for simultaneous drilling and tapping of typewriter frames at a rate of 400 per hr, this multi-spindle machine is easily adapted to other uses. It has 16 or 24 spindles. Half of the spindles, located on one side of the head, are used for drilling, and are driven by a standard motor. Those on the other side are driven by a high-reversal-duty hydraulic tapping motor.

In the machine illustrated, the table moves up and down hydraulically—rapid traverse up, feed up, feed down, and rapid traverse down. Two feed rates may be used, with automatic change if needed. Individual spindles have high and low speeds.

National Automatic Tool Co, Inc, Richmond, Ind

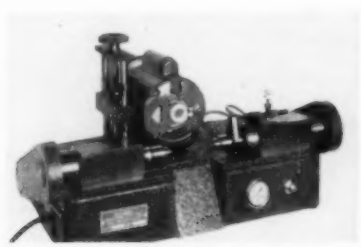


Machine Grinds OD's and Throats Of Sheaves up to 42 in. in Dia

Latest addition to the company's line of abrasive belt equipment is this sheave grinder that grinds both the throat and OD of sheaves from 10 to 42 in. in diameter. A formed contact wheel grinds the groove and the work is then moved under the flat faced contact wheel to grind to OD.

Interchangeable contact wheels and extra adapters make it possible to accommodate various sizes of sheaves. Horsepower ranges from 5 to 10 hp; variable speed drives are available.

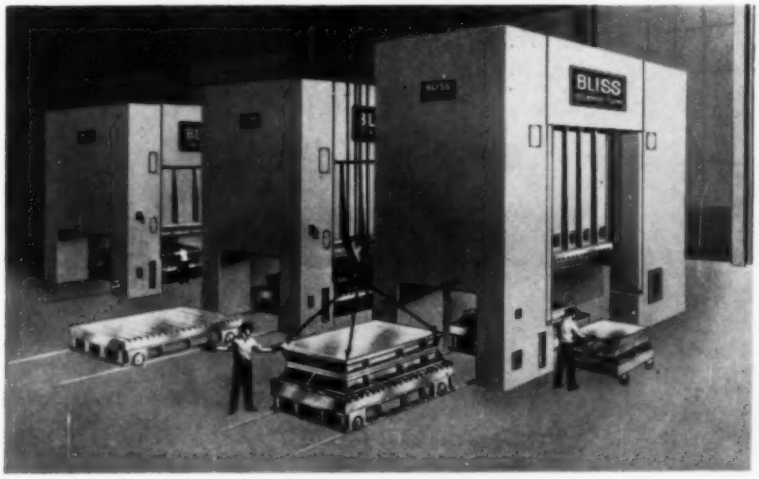
Grinding & Polishing Machinery Corp, 2530 Winthrop Ave, Indianapolis 5, Ind



Opposed-Spindle Machine Deburrs Both Sides of Holes

This bench-type machine uses opposed spindles to deburr both sides of holes from 1/32 to ½ in. diameter. Spindles rotate in opposite directions, eliminating cutter torque, thus making hand feeding safe and easy. Machine is foot controlled and spindle is air operated, leaving both hands free to feed the machine.

Model Machine Co, 4729 Hawthorne St, Philadelphia 24, Penna



Self-Powered Moving Bolsters Cut Die Changeover Time

Adaptable to all types and sizes of presses, the moving bolster concept greatly increases press output. Each bolster carries its own pressure pins and a pressure pin plate to retain the pins while the bolster is moving into or out of the press. The bolsters are self-powered, with each traveling bolster assembly being controlled from a master control panel.

The bolster travels on special tracks to a lowering mechanism built into the press bed which lowers and positions the bolster assembly into the press. While this die is stamping out parts, another die is being secured to the other bolster outside of the press. To change dies, the bolster in the press is rolled out and the other bolster is rolled into position.

Further cuts in die changeover time are made possible by two other developments—automatic die clamping and slide positioning.

E W Bliss Co, Press Div, 1375 Raff Rd, SW, Canton, Ohio

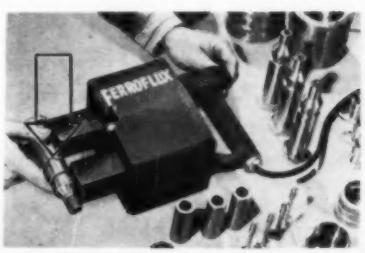
Cast Aluminum Tooling Plate And Bar Stock Available

Cast under highly controlled conditions, then stress relieved and machined top and bottom on planer mills, these "775" plates are reported to be entirely free of internal stresses, and they will not change dimensionally after cutting or welding. Material has wide application for machine tool fixtures, assembly jigs, and hydropress form blocks.

The special alloy used is corrosion resistant and needs no protection even if stored for long periods. Both upper and lower surfaces are machined to a finish suitable for direct layout or as a base for photographic emulsions, layout blue, lacquers or dyes.

Plates are available in sizes up to 48 x 144 in. and up to 5 in. thick. For special applications, it can be furnished in thicknesses up to 15 in. and in bar stock, sawed to size and machined on all surfaces.

Red Seal Metals Co, 10035 Burtis St, South Gate, Calif

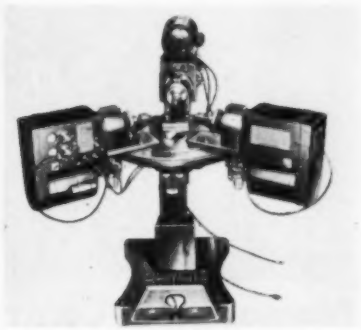


Magnetic Inspection Unit Detects Surface and Sub-Surface Defects

Ferroflux, a lowcost, portable magnetic inspection device detects surface and sub-surface defects in ferromagnetic materials. It weighs only 23 lb, and consists essentially of a U-shaped, 110-v electromagnet. Unit is easy to use in many places too difficult to reach with heavier and more expensive equipment.

Unit is placed on the part to be examined, so that both poles are in contact with the part. The current is turned on and the area immediately surrounding the pole assembly is painted with a solution holding minute particles of iron in suspension. These particles will concentrate wherever there is a surface or subsurface break in the magnetic field. Instrument comes in a wood carrying case and is supplied with inspection fluid and an applicator. Kit is priced at $395.

Ferro Machine & Tool Co, 551½ W Washington St, Indianapolis, Ind

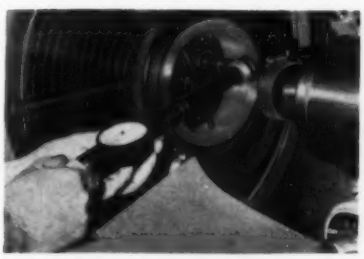


Circular Table Assembly Holds Up to Six Tooling Components

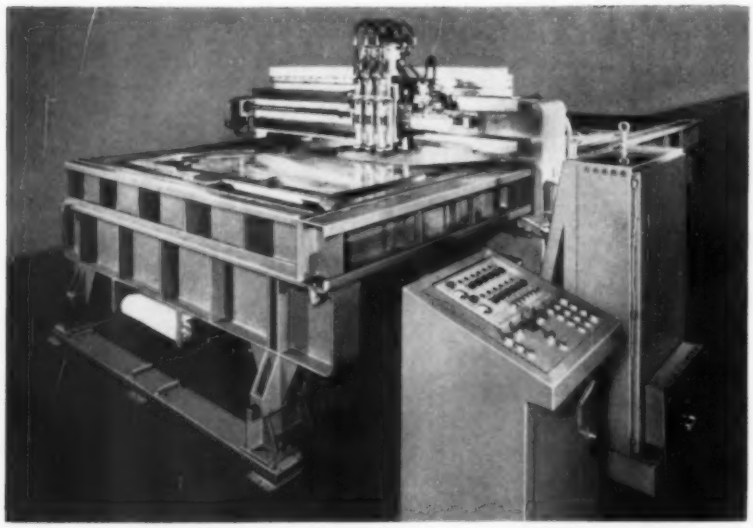
Compact stand provides mounting space for up to six tooling components for small parts machining in automatic production. Assembly consists of circular table which can be manually turned for fixture positioning, 27½-in. column, clamp for holding table, and base to which pedal can be added.

Typical setup with three Series 28 automatic Drill-N-Tap units is illustrated. Units are nose-mounted, with brackets, in position for automatic drilling, tapping, and facing work. Tables are available with or without Dumore automatic machining units.

Dumore Co, 1300 Seventeenth St, Racine, Wis



RIGHT-ANGLE BORE GAGE is useful for measuring work in jig borers, internal grinders and horizontal boring mills. Six sizes cover the range from ⅜ to 6⅛ in. Sets are available comprising a single dial unit and two interchangeable heads covering ⅜ to 1 in.—*Standard Gage Co, Inc, Poughkeepsie, NY*



Numerically Controlled Drill Eliminates Templets and Layout Time

A two-dimension, point-to-point, numercially controlled drilling machine, the 2DNC McKaymatic is capable of handling workpieces 8 ft wide by 16 ft long. Designed to eliminate templets and layout time, the machine has a gantry-type drill carriage to conserve floor space and a three-unit drillhead which permits selection of three different sizes of drills or counterboring tools.

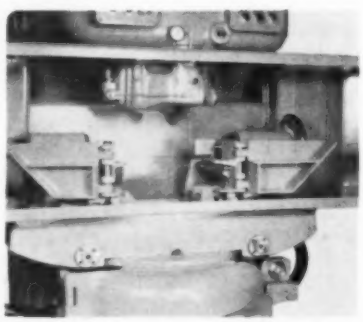
Machine can handle two wing skins for the F-102 jet fighter simultaneously. Drill positions with respect to an X axis (200 in.) and a Y axis (108 in.) are programmed in binary code on 1-in.-wide paper tape. Tape actuates the Farrand Inductosyn control.

Control consists of a tape reader, decoder, stepping switch assembly, power supply and amplifier unit, a data zero offset unit, the inductosyn scales and reader, and servo valves.

There are three independent analog voltages representing position—coarse, medium and fine. Coarse control covers dimensions from 0 to 200 in. in steps of 1 in.; medium, from 0 to 10 in. in steps of 0.01 in.; and the fine, from 0 to 0.1 in. in steps of 0.001 in. A fine position control can be set to repeat within ± 0.0001 in.

The equipment is capable of drilling holes in 5/16-in.-thick aluminum on 1-in. centers at the rate of one hole every 5 sec and will position to an accuracy of 0.005 in. in 200 in. travel. Repeatability is held to within ± 0.001 in.

McKay Machine Co, Youngstown, Ohio



Red Ring Roller-Chain Load Rail Speeds Gear Shaving Operations

Design simplifies loading of heavy gears in rotary gear shaving machines. Skidding of the gear shaft bearing or arbor surfaces, which occurs with slide rails, is reportedly eliminated.

Gear is first lowered onto load rails, then rolled forward to engage rollers supported by a conventional roller chain. Chain rollers permit freedom of straight-line, back-and-forth movement. The five rollers attached to the chain permit free rotary motion of the gear so that it can be easily advanced or retracted while being rolled into mesh with the shaving cutter. When the gear is in proper mesh, tailstock center is advanced with a handwheel and work is in position for the shaving cycle. Design can be adapted to suit a variety of rotary gear shaving machines.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

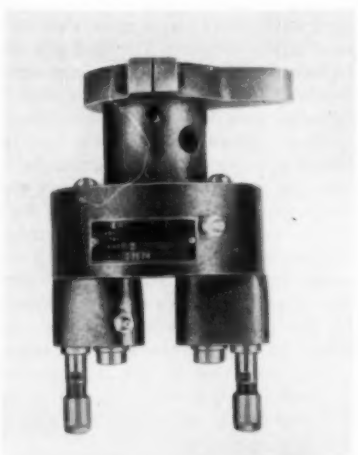
Electronic Dust Precipitator Operates at High Face Velocities

The Electro-cell electronic dust precipitator is now offered in a design which operates at face velocities of up to 600 fpm. High efficiency (up to 97% collection efficiency, National Bureau of Standards test) is maintained while over-all compactness has been improved. Actual size reduction is 30% in face area and 50% in cubic requirement over conventional precipitators.

This high velocity model features sectional construction for ease of assembly. Individual cells contain positive and negative collector plates fixed in position. Each cell has its own set of vertical ionizing wires. The former model had a separate ionizer section.

The all-aluminum collector cells are available in heights of 16 and 20 in., and widths of 24 and 36 in. Cell capacity ranges from 800 to 2750 cfm. Bulletin 258.

American Air Filter Co, 215 Central Ave, Louisville 8, Ky



Lightweight Adjustable Drillhead Takes up to Four Spindles

Adjustable drillhead features a new clamping principle that permits a weight reduction of up to 50% over previous adjustable drillheads. It has over $\frac{3}{8}$-in. drill capacity and is made with two, three or four spindles.

Designed primarily for use on drill units as well as bench model drill-presses where space is limited, this unit utilizes aluminum castings to reduce weight. Gears, spindles and shafts are one piece, hardened and ground.

Errington Mechanical Laboratory, Inc, Staten Island 4, NY

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and they will do more work for you!

The Most Complete Line of high production cutting tools available to industry today.

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14 standard grades of cemented carbides to fit every metal-cutting application including the machining of the superalloys.

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Cast alloy cutting tool material for applications requiring cutting speeds between the maximum possible with high speed steel and the minimum practical with cemented carbides.

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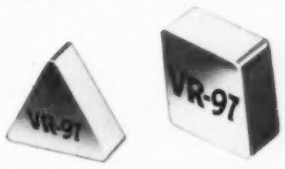
Aluminum oxide cutting tool material for ultra high-speed machining.



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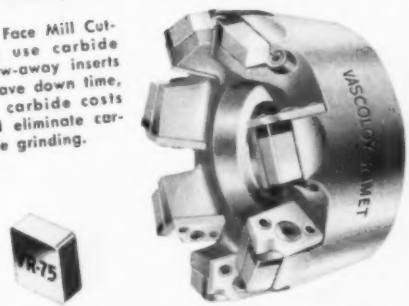
Both Elevator Type and Solid Base Type are available in styles for all applications. Full length and throw-away carbide and ceramic inserts.

V-R FACE MILL CUTTERS

V-R Face Mill Cutters use carbide throw-away inserts —save down time, cut carbide costs and eliminate carbide grinding.



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SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

868 Market Street • Waukegan, Illinois

C-668

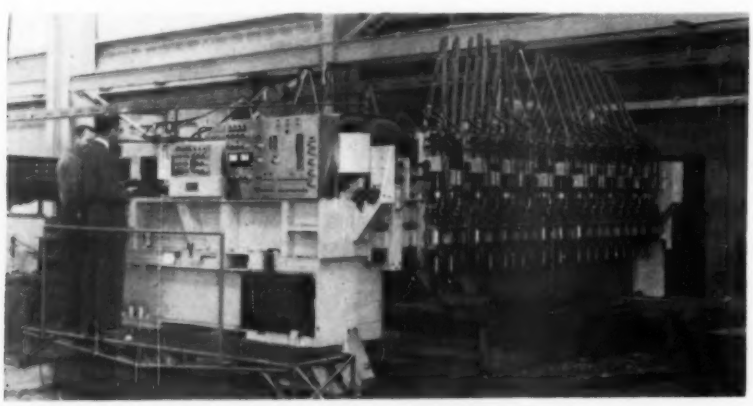
Machine Uses Throwaway Abrasive Tools to Finish Hardened Gears

Hardened small and medium-sized gears up to 12-in. dia can be finished to quiet-running smoothness by this Model 999 Hard Gear Finisher which uses abrasive throwaway tools. The greater quietness—without matching of gears in pairs—is obtained by tightened dimensional accuracy, improved surface finish and contact pattern, and materially reduced noise characteristics. Machine also permits salvaging of gears otherwise too noisy to meet desired standards. The compact machine (only 5 x 6½-ft floor space) is applicable to either high or low production.

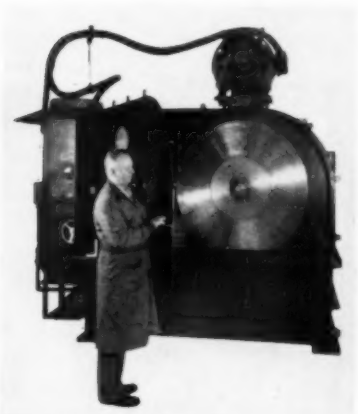
The abrasive-impregnated plastic gear-shaped tool can be used for finishing spur and helical gears. The tool rotates in close contact with the gear it is to finish at a predetermined pressure and drives it in a crossed-axis relationship of about 25°. Reciprocation of the work table traverses the part across the tool for its full face width—with the part running in both directions during the process. The finishing action cleans up small deviations in tooth form and lead to reduce noise characteristics; any nicks and burrs are also removed at the same time.

Machine is adaptable to manual, semi-automatic or automatic loading. Maximum length between centers is 24 in. Average cycle time is little more than a minute. The finishing-tool mount is on an adjustable head that is outboard mounted for easy tool change. Tool head settings are made from either a graduated scale or positive stops. Tool spindle is motor driven through a variable-speed drive to provide an adequate range of tool speeds from 52 to 283 rpm.

Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich



INLINE MULTIPLE DRILLING MACHINE has 18 vertical drilling heads on the front rail, two vertical and four horizontal heads on the back rail. Machine moves over the bed at low speeds of 12 to 20 ipm or at high speeds of 40 to 55 fpm. Drillheads move on the rail at a rate of 9 ipm. Unit has a max drill size of 1¼ in. and will handle work as large as 12½ x 120 ft. Maximum drillhead stroke is 4 in. All controls are on the panel. Machine is of modular design and can be suited to individual requirements—*Valley Engineering Corp, 15th & Elm Sts, Easton, Penna*



Friction Saw Has Electronic Feed, Requires No Pit

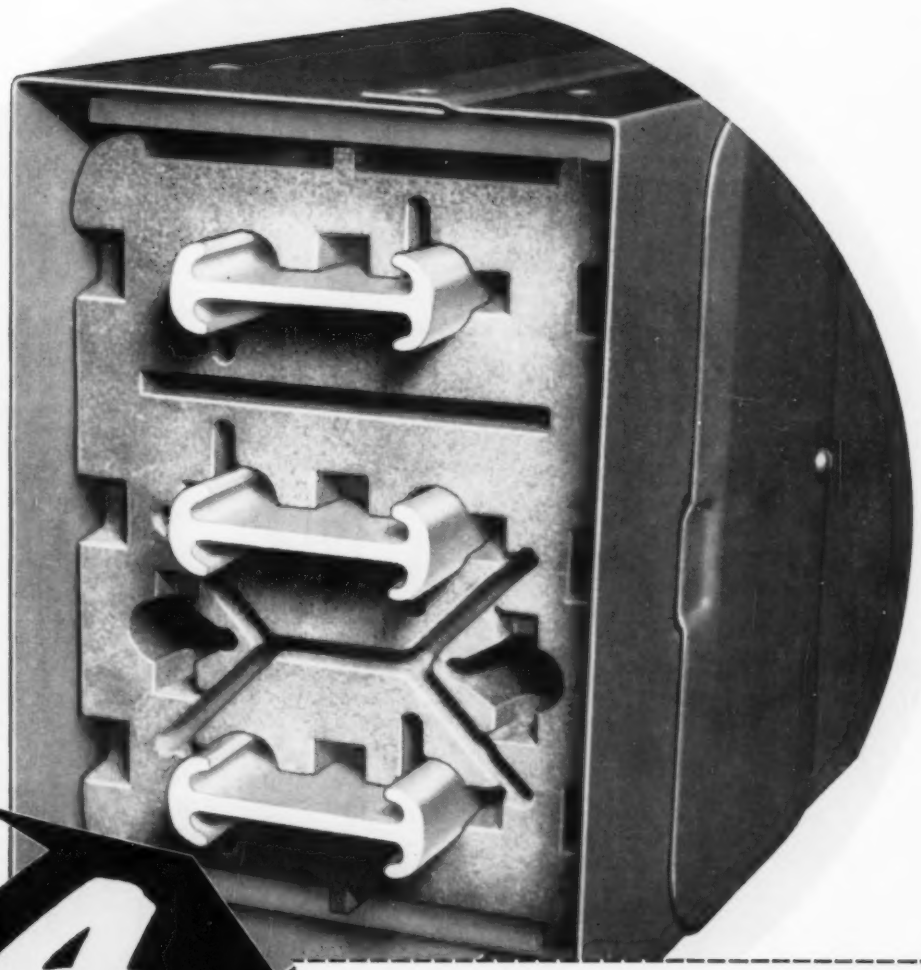
Friction saw is reported to incorporate several major innovations. A new electronic feed replaces the old hydraulic system; a unique coolant system assures cool-edge, dry-blade cutting; and one-piece construction permits the saw to be used as a semi-portable unit or without a pit.

The high blade speeds generate an air-flow barrier that partially repels sprays. A 15-hp pump propels a high speed water stream that penetrates the surrounding air barrier as the blade leaves the cut. This gives the edge time to cool and dry before it re-enters the cut. A specially designed guard prevents the coolant from getting in the cut; coolant in the cut lowers the metal temperature and defeats the principle of friction sawing.

A steel cover encloses the blade except for the material opening. The operator's station is shielded on three sides and has an unbreakable observation window.

Ty-Sa-Man Machine Co, Inc, 1001 White Ave, Knoxville, Tenn

SQUARE D's New Aluminum Plug-In Duct with Exclusive I-BEAM Design!



4 TIMES STRONGER

Square D Company, Dept. SA-20
6060 Rivard Street, Detroit 11, Michigan

Send me Bulletin SD-110 which gives the complete story of Square D's new aluminum plug-in duct.

Name_____

Company_____

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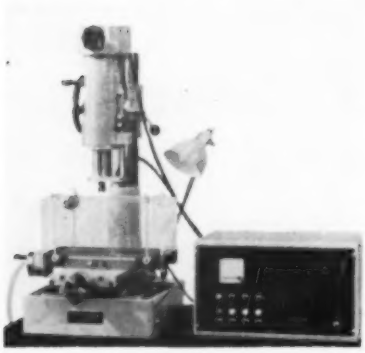
SQUARE D COMPANY



Spark-Erosion Machines Provide Reduced Electrode Consumption

Swiss-made Agietron spark-erosion machines offer reduced electrode consumption, high surface finish and high working accuracy. Model AA05 (illustrated) is designed for precision machining of the smallest dimensions. Maximum stock removal is 0.003 cu in. of steel per min, with a corresponding electrode wear of less than 20% (based on a round electrode). Electrode wear as low as 5% has been obtained when running hardened tool steel or stainless steel with a copper electrode. Normal working accuracy is ±0.0004 in.; surface finish is 10-12 mu-in. with hardened steel and 5-6 mu-in. with carbide.

Standard power pack on this model is a 500-w unit, though others can be supplied for heavier work. (The heavier machines in the line can be equipped with power packs delivering up to 12 kw.) Two outstanding features of this machine are its ability to bore holes as small as 0.002 in. dia and its measuring ability, which is provided by a Leitz optical system. This specially equipped optical table has a movement of 6 in. in both directions and a reading accuracy of 0.00005 in.

Distributed by Cosa Corp, 405 Lexington Ave, New York 17, NY

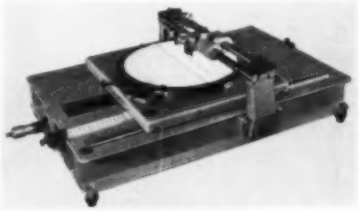
Square D Introduces Line of Electronic Welder Controllers

Line of non-synchronous electronic combination welder controllers is designed to give the performance required on high speed production lines and the flexibility to meet changes in materials and designs.

Flexibility and simplified maintenance are achieved by functional breakdown of the control into individual panels for sequence timing, power supply, valve operation and contractor firing.

Provision is made for the plug-in addition of heat control, slope control, current regulator, forge delay, dual control functions and other special features. Bulletin SM-277.

Square D Co, 4041 N Richards St, Milwaukee 12, Wis

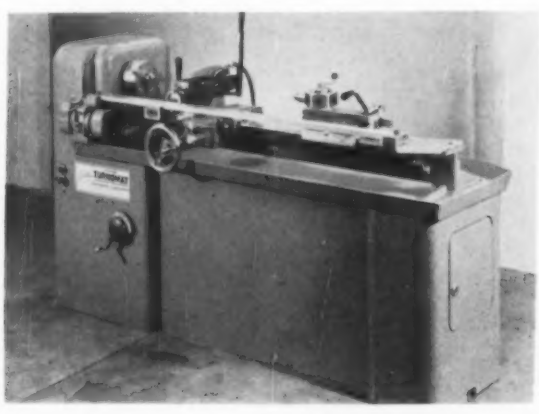


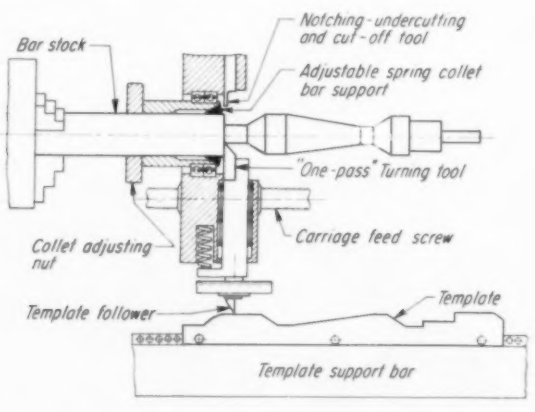
Scribing Machine Produces Optical Comparator Layouts

Model A-14 scribing machine produces high accuracy optical comarator layouts on glass or plastic. Designed for accuracy on the order of 0.001 in. or better, the machine features a free-floating table and scribe carrier to speed layout work.

Table area of the unit accomodates glass or plastic chart material up to 14 in. in diameter and 11 x 14 in. rectangular. With the use of an accessory plotting microscope the machine can be converted into a precision layout checker.

Optical Gaging Products, Inc, 26 Forbes St, Rochester 11, NY





Automatic Centerless Machine Turns Intricate Shapes

The Karge Turnomat automatic centerless turning machine, Model 901-1750, produces intricate shapes, contours and tapers in one pass with a single point tool. This is accomplished without the support of headstock or tailstock centers or steady rests; the traveling Turnomat spindle collet and single point tool move along the bar as a unit.

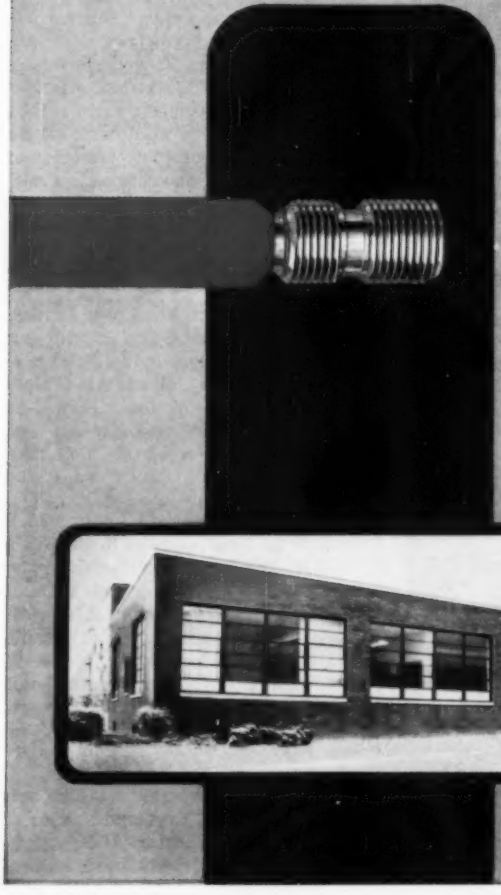
The machine handles bars from ⅜ to 1¾ in. in diameter. The contour and diameter to be turned are controlled by templets, ground or machined to the exact shape. Shoulder-to-shoulder length dimensions are determined by conventional lathe multiple micro-stops or length rods. There is no limit on the total length of the workpiece.

Because the tools are close to the face of the traveling collet, it is possible to plunge-cut to the smallest diameters without a trace of chatter. Tolerances can be held within 0.0005 in. or better.

Spindle speeds are variable from 100 to 1600 rpm; feeds are variable from 0 to 0.005 ipr. The turning head has a maximum travel of 48 in. Included as standard equipment are a 30-gal coolant tank, one templet, one templet follower, one turning tool, and one cutoff and notching tool.

Taber Instrument Corp, 111 Goundry St, North Tonawanda, NY

Here's What One Government Gage Laboratory Says about PIPE MACHINERY HILO SET PLUGS



A well-known government gage laboratory recently reported on their study of our Hilo Thread Setting Plug Gages as follows:

"The setting plugs were used to retest several of the thread rings we had in stock. The results were enlightening. Some were rejectable because of worn flank; others were rejectable or borderline because of bell mouth.

"The HILO Setting Plug is unquestionably sound and superior . . . a saving of many man hours by less skilled help for acceptance inspection and surveillance can be foreseen."

A word to the wise is sufficient. You, too, can employ no more positive method for setting your thread ring gages and other adjustable instruments for the inspection of male threaded parts than with Pipe Machinery Hilo Set Plugs.

Stop in and see us when you're in the Cleveland area.

THE PIPE MACHINERY COMPANY
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Wickliffe, Ohio
Greater Cleveland

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Eliminate Costly, Unnecessary Metalworking Operations . . .

and produce

a better product!

7 station die ribbon for Grinnell sprinkler head.
Note: piercing, marking, blanking and forming in one press operation.
Stock: .065 brass.
Production: 72 pieces per minute.

With B. Jahn designed and engineered progressive dies, mass producers eliminate unnecessary press operations, marking operations, parts handling, intermediate inspection.

Part uniformity, product quality, production savings and profit improvement are all advantages which result in a better end product at an economical mass production price!

Progressive Mass Producers save with B. Jahn Progressive Dies!

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Send today for colorful 20 page "CASE HISTORY" Brochure!

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

Milling Machine Has Power Feeds And Power Rapid Traverse

This No. 2 light-type milling machine, the Swedish-made SAJO Model 53A, is available in both plain and universal models. The spindle uses double-row staggered cylindrical roller bearing for radial load and ball thrust bearings for axial load.

Specifications include a table working surface of 43¼ x 10¼ in.; longitudinal power feed of 28 in.; power feeds and power rapid traverse in all three directions; dial selection of feeds and speeds; one-shot lubrication; and backlash eliminater.

Machine is equipped with a No. 40 Am. Std. taper spindle and a 5-hp motor drive. A complete selection of attachments and accessories is available.

Distributed by Austin Industrial Corp, 76 Mamaroneck Ave, White Plains, NY

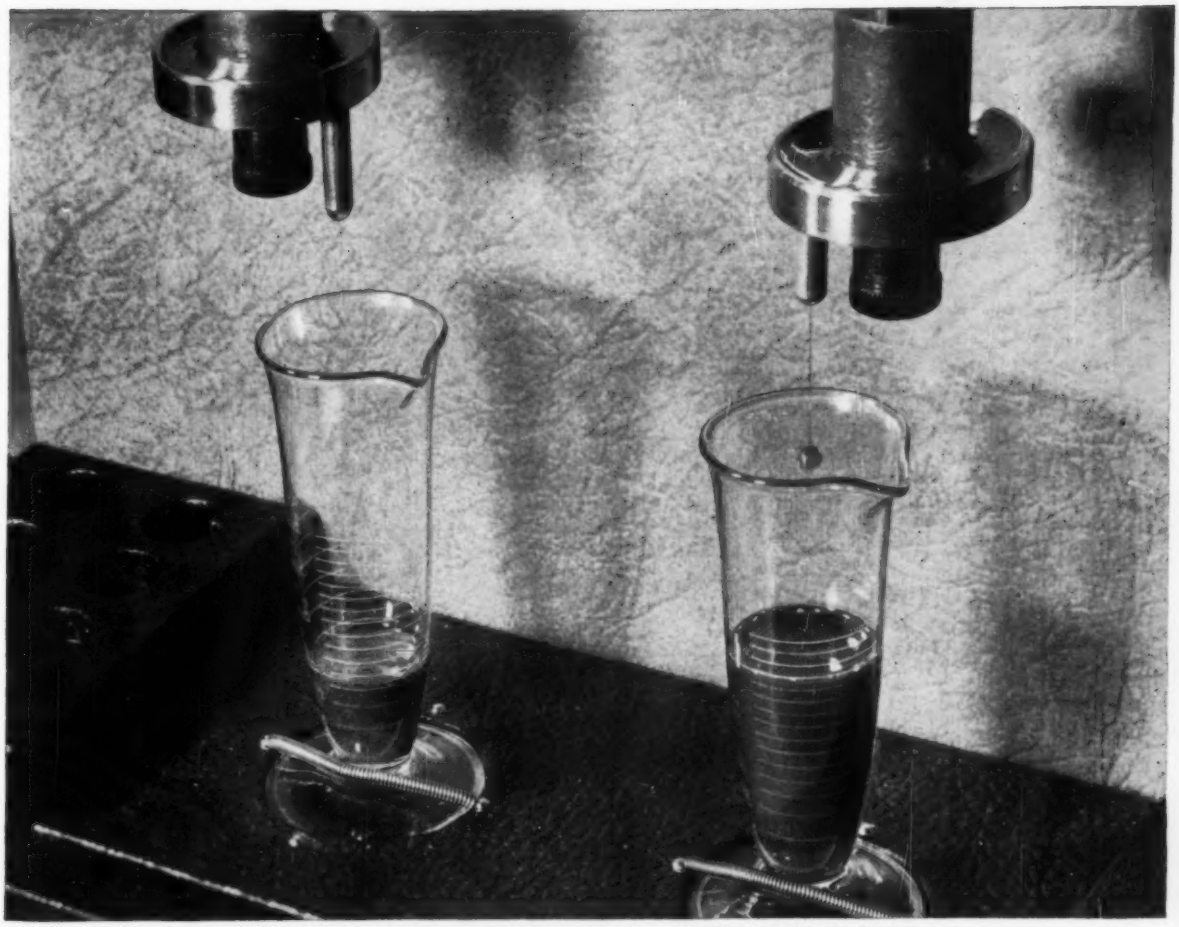
Drilling lubricant, known as Drill & Tap Lube, is reported to provide superior performance in drilling, tapping and reaming all metals. Prices range from $12 for one dozen 8-oz bottles to $5 a gallon in 30-gal lots.

Protective Coatings, Inc, Box 3985, Detroit 27, Mich

Hand Tapper for producing precision threads in size range of from No. 0 to ½ in. can be used with drillpresses, lathes, jig borers, and vertical millers. Unit is furnished in a hardwood box, complete with adjustable chuck and chuck wrench. Model 44 has No. 8 to ½-in. chuck; Model 44A has No. 0 to 5/16-in. Price $30 fob.

Grimes Engineering Corp, 1187 College Highway, Cheshire, Conn

Punch and die button retainer sets permit different sizes and shapes of punches and die buttons to be quickly inserted in already mounted re-



The oils collecting in these graduates are being forced, at 100 psi, through two sintered bronze bearings. Although each oil has the same viscosity, the Suntac on the left is leaking *only one quarter as much as* the straight oil on the right.

Desk-top demonstration proves that SUNTAC HYDRAULIC OILS can cut your oil losses . . . up to 75%

Suntac® oils are competitive in price, competitive in quality, *and unique in their ability to reduce oil leakage without costly shutdowns.*

Suntac oils are high-quality, exceptionally stable mineral oils especially compounded to reduce leakage. Experience proves that they give longer pump and seal life with higher overall operating efficiency.

See for yourself how a Suntac oil can cut your oil costs. A simple desk-top demonstration will show you how.

Ask your Sun man to show you how others have reduced oil consumption, or write to Dept. AM-7.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

© 1958 SUN OIL COMPANY

In Canada: Sun Oil Company Limited, Toronto and Montreal

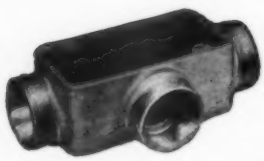
ONLY

GOSS and DeLEEUW AUTOMATIC CHUCKERS offer the 1-2-3 feature

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.



The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DeLEEUW

tainers. Each of the Inter-Mount sets contains a master retainer and a reducing retainer. Any punch size or shape (with punch shank diameters from ½ to 2¾ in.) can be mounted in one master retainer; die button set accommodates units with OD's from ½ to 3 in. in dia. Reducing retainers are inserted in the master retainer; therefore, hole in the master and OD of reducing retainer are identical and constant, regardless of punch or die button size.

Allied Products Corp, Richard Brothers Punch Div, 26500 Capitol Ave, Detroit 39, Mich

Adjustable Boring Bar Uses Throwaway Turnover Inserts

Adjustable boring bar uses Kendex throwaway turnover inserts. Any diameter between 2¼ and 3¾ in. can be bored. Three heads, each with a half-inch adjustment, cover the entire range.

The bar is of heat treated alloy steel and is designed for a wide range of boring operations. Tool is reported to be extremely rugged.

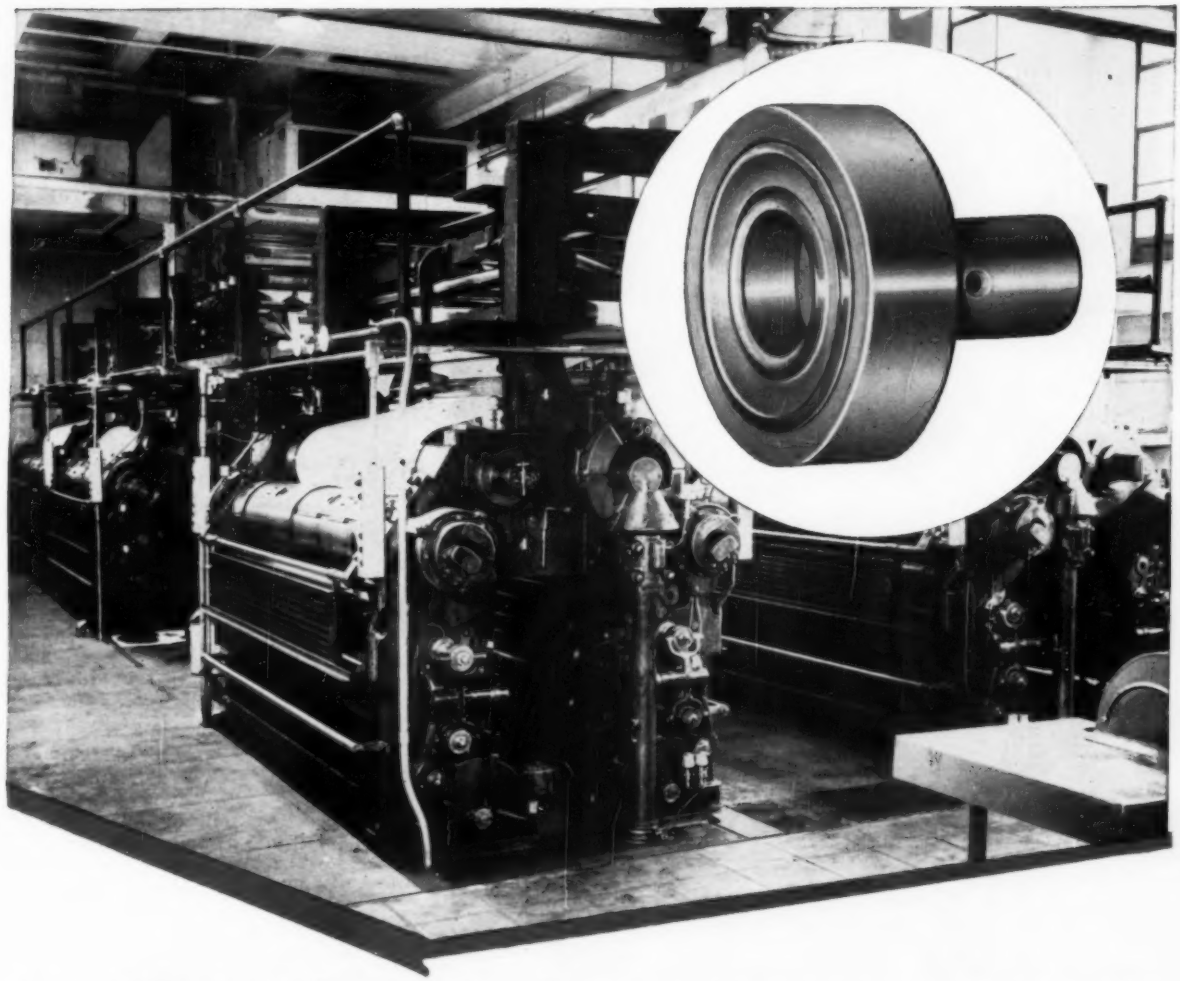
Kennametal Inc, Latrobe, Penna

Titanium forming lubricant, T-50, is said to reduce galling and permit lower die temperatures. Material can be sprayed or brushed, and air dried. After forming, the product is easily removed with solvent.

EverLube Corp, 6940 Farmdale Ave, North Hollywood, Calif

High pressure coolant unit for use in gun drilling operations is available in four models with gpm output range from 7.7 to 35 at 1000 psi. Tank capacities range from 55 gal to 150 gal. All models have pressure adjustable from 0 to 1000 psi.

Madison Industries, Inc, Muskegon, Mich



It's Bearings, Inc. wherever shafts or wheels turn. We have the experience . . . . the bearings to solve any problem!

Even on printing presses such as this at the Warren, Ohio, Tribune Chronicle. As originally built, the shafts on the ductor and plate rolls turned in a metal to metal housing. Wear on the shafts made complete adjustments necessary with every roll change. The rolls would not distribute the ink properly and the printed pages were heavy with ink on one end, light on the other.

By incorporating the studded bearing housing, shown above, all the rolls are held evenly and adjustment remains constant. All shafts were shortened to accommodate the bearing housing stud length, with anti-friction bearings.

Fifty of these housings and ball bearings are now installed and according to the press room foreman, Jack Marlin, they are doing a great job. Roll changes are now made in much less time and the ink is evenly distributed over the printed pages.

You probably don't have a printing press in your plant, but you would be exceptional if you didn't have bearing problems — We're on call, 24 hours a day, to help you solve them — Call the branch nearest you for quick, experienced service.

Providing bearing service in the North ➤ **BEARINGS, INC.**

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Buffalo, Bolanrol Corp. • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the South ➤ **DIXIE BEARINGS, INC.**

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans
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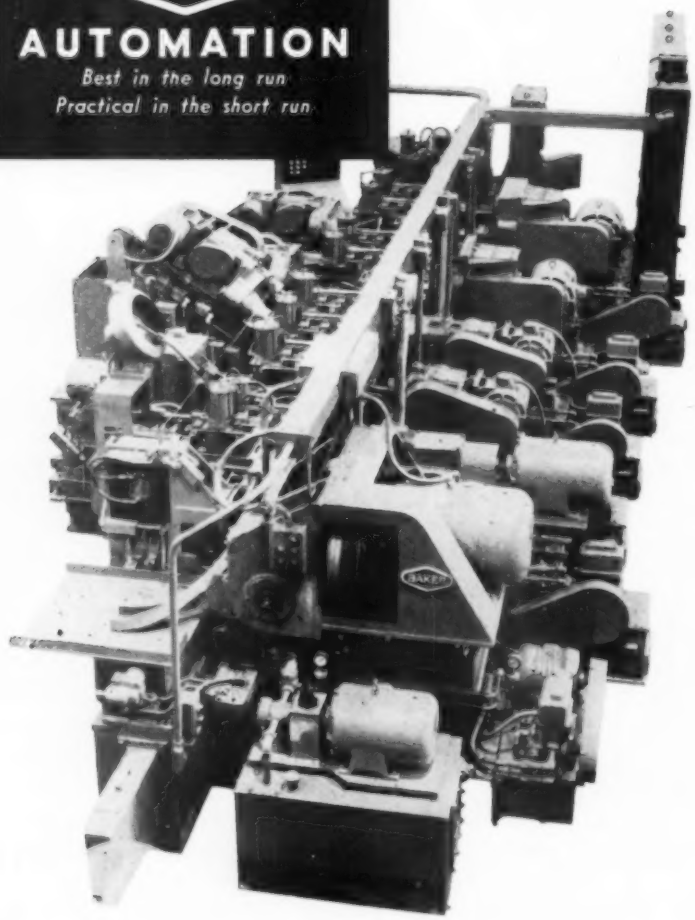
BAKER

AUTOMATION

Best in the long run
Practical in the short run



THIS BAKER SPECIAL

ups production to 75 main bearing cap assemblies per hour.

Operations are: drill, ream, mill, tap, assemble dowels, and separate — all automatic.

OLD TIMERS' CORNER

Remember when Baker made nothing but gear-feed drilling machines? Quite a contrast with modern Baker specials — the bulk of Baker output today.

BAKER BROTHERS, INC.
Dept. AM-78, Toledo 10, Ohio

Send me data on automation with
☐ Baker Specials . . . ☐ Baker *standard* machines.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

NEW SHOP EQUIPMENT

Diamond wheel, designated E-2 Bond, for electrolytic grinding is said to have the following features: reduced weight for longer spindle bearing life; immediate start with no break-in time necessary; longer life; faster stock removal; new design to increase coolant to point of contact.

A I T Diamond Tool Co, 8221 N Kimball Ave, Skokie, Ill

Liquid Spring Shok has built-in time delay of one second. Standard model may be modified to provide time delay return up to ½ hr on a ½-in. stroke. By absorbing 98% of the input energy, unit returns the dampened device from 1 second to 30 minutes. Also available with adjustable energy absorption rates. Details in Data Book S.

Taylor Devices, Inc, 188 Main St, North Tonawanda, NY

5000 F electric furnace, Pereco Model CT, has been introduced in a vertical design. Loading of work is accomplished hydraulically and at a rate of vibrationless movement of the load bearing column that can be infinitely controlled through the travel range, making it compatible with the type of specimen being tested. Over-all size is 35 in. wide, 45 in. deep, 86 in. high.

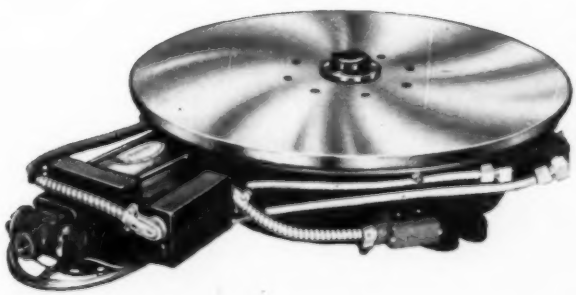
Pereny Equipment Co, 893 Chambers Rd, Columbus 12, Ohio

Woven wire cloth is available up to 500 mesh; openings to 2 microns; all metals and alloys; all weaves; specialties. Pieces cut to specification.

Imported by J R Mills & Co, 1900 Winnetka Ave, Northfield, Ill

"I'll join you later. I want to spend these last few moments alone with my paycheck."

This "do it yourself" Automation Kit can cut hole drilling costs ...in half!



WHY HESITATE?

No cost to investigate —

Let us send you a set of engineering bulletins showing how you can use these versatile units; plus typical case history stories showing how others are cutting drill press costs.

Write Dept. AM-758, The Bellows Co., Akron 9, Ohio. (In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ont.) Ask for Bulletin DP-110 RT.

The kit consists of two units: a Bellows Drill Press Feed which attaches to the star wheel shaft of a drill press and feeds the spindle automatically; and a Bellows Rotary Feed Table which positions parts under the spindle and removes them automatically.

These two "automation" production units can turn almost any standard drill press into a high speed automatic machine. All the operator has to do is load and unload the feed table. Easily adjustable controls permit precise regulation of feed rate to fit the needs of any tool working in any material.

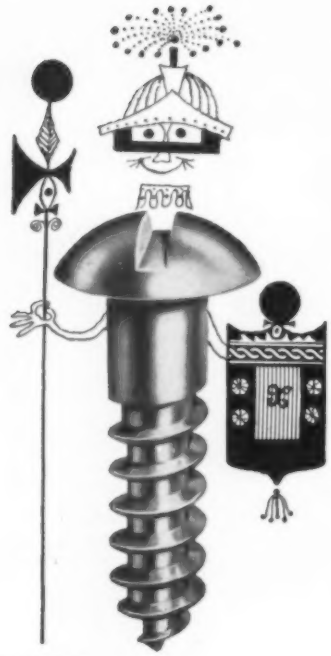
Your own tool room people can make the installation quickly. The total cost rarely runs more than the wage cost of a single operator for a few weeks. And the chances are good your savings will offset the price even before our bill is due.

1124-B

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO



YOU'RE PROTECTED...FROM UGLY CORROSION STAINS WITH ALCOA ALUMINUM FASTENERS

Don't let ugly corrosion stains spoil the appearance of your products. Make them of aluminum, fasten them with Alcoa® Aluminum Fasteners for lasting sales appeal. Low-cost, carefree aluminum fasteners protect your aluminum products against both galvanic and atmospheric corrosion. And they are readily available in complete stocks . . . all standard sizes and types at your local Alcoa distributor; or call your nearest Alcoa sales office. Look in the Yellow Pages of your telephone directory. ALCOA IS A "NATURAL" FOR SPECIALS, TOO!

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Exciting Adventure
Alternate
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Aluminum Company of America
2238-G Alcoa Bldg., Pittsburgh 19, Pa.
Gentlemen: Please send complete specification data and samples of Alcoa Aluminum Fasteners.

Name_____
Title_____
Company_____
Address_____

Platen Arbor Presses Have Removable 12 x 12-in. Platens

Two new platen arbor presses have been added to company's line. These 5- and 7½-ton presses are equipped with 12 x 12-in. platens for easy attachment of dies and heated platens, as well as regular operations such as bending, forming, laminating and broaching. They have adjustable power thrust and daylight, 4- or 8-in. stroke, 6½-in.-dia non-rotating rams, and a 7½-in. throat. Maximum daylight is 12¾ in. Prices start at $535. Bulletin available.

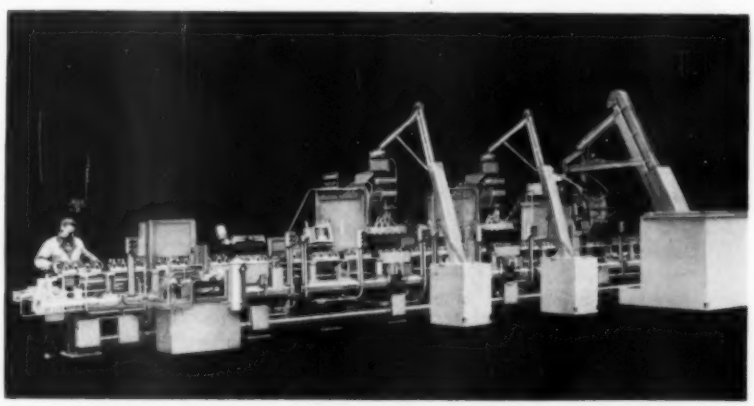
Van Products Co, 5712 Swanville Rd, Erie, Penna

HEAVY-DUTY COUNTERBORES with either HSS or carbide-tipped cutters feature spline-taper drive. This is said to insure permanent alignment and allow complete interchangeability of pilots, cutters and holders. Wide range of counterboring and countersinking operations are possible with minimum tooling. Worn cutters are easily replaced—*National Twist Drill & Tool Co, Rochester, Mich*

Submersible ac electric motors for direct coupling to pumps that must operate while submerged in oil, water, or liquid chemicals, are available as polyphase, single-voltage units in sizes from ¾ through 15 hp. They are rated at 55 C temperature rise for 30-minute duty in 40 C air, and for continuous duty in 40 C liquid.

Reliance Electric & Engineering Co, 24701 Euclid Ave, Cleveland 17, Ohio

Nylon brush, designed especially for machine operators and cleaning jobs, is reported to outlast other brushes by 7 to 10 times. Brush is unaffected by alkalis, detergents, oils and greas-



V-8 CYLINDER HEADS are assembled at the rate of 310 per hr on this 29-station machine. A transfer mechanism lifts and carries the parts between the stations, eliminating pallet fixtures. Building-block construction provides flexibility for engine design changes and for additional automatic assembly devices in the future. Construction to JIC standards and automatic lubrication are featured—*Cross Co, Park Grove Station, Detroit 5, Mich*

YEARS OF PROFITABLE PRODUCTION

BUILT INTO

"BUFFALO"

NO. 18 DRILLING MACHINES

These drills are constructed to provide the longest possible useful life and the utmost accuracy in operation. Easy to set up and operate, the rugged, dependable No. 18 is designed to cut production costs in a wide variety of operations.

Quality Features of the "Buffalo" No. 18 Drill:

- **SPINDLE** — Multiple-splined alloy steel, ground, polished and carefully balanced. Rotates in two precision-type ball bearings, designed to take the thrust of heavy-duty operations. Design of spindle pulley bearings prevents torque being transmitted directly to spindle.
- **FRAME** — Large, heavy head frame insures accuracy throughout life of machine.
- **TABLES AND BASES** — Built to extra-heavy proportions, with large working surfaces.
- **RAISING SCREW** — Full ball bearing construction, actuated by machine-cut steel screw and gears. Three ball thrust bearings provide easy operation.
- **FOOT FEED** — Operated by a gear meshing the feed pinion. Foot treadle return by torsion spring, giving maximum return pressure at end of stroke.

For capacities up to 1" in cast iron, the "Buffalo" No. 18 Drill is your best buy. Available in floor and bench models — bench types up to 6 spindles.

Contact your "Buffalo" machine tool dealer for full information on the No. 18 Drill, or write us direct for Bulletin 3123-E.

Every "Buffalo" Machine Tool brings you the exclusive "Q" Factor—the built-in QUALITY which provides trouble-free satisfaction and long life.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

509 BROADWAY • BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

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Harron, Rickard & McCone Co.—ATwater 2-2202
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QUEBEC
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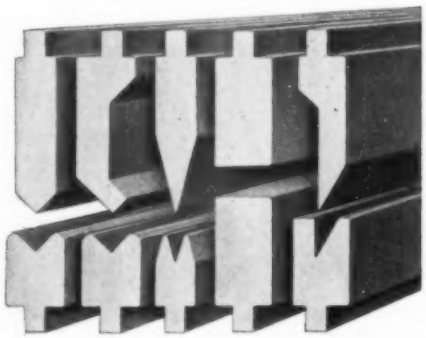
8467

Off-the-shelf DELIVERY



CHICAGO®
*Induction Hardened**
PRESS BRAKE DIES

This organization of local distributors offers immediate delivery on many CHICAGO *induction hardened* press brake dies. These stock dies are economical, and the quick delivery saves time in tooling. They are available in any length from 4 to 12 feet in increments of 2 feet.

Stock dies are used for a surprisingly large variety of bending operations. And, with CHICAGO *induction hardened* dies you get bonus performance and increased die life at no extra cost. Remember, these dies can be used in any make or size of standard press brake.

On your needs for press brake dies, call your nearest distributor listed here. With Bulletin D-457 you can order by number. Ask for a copy.

*Induction hardening is a special, high-frequency process used to harden the wear surfaces of CHICAGO dies. Field reports on CHICAGO *induction hardened* dies show up to ten times longer life than conventional press brake dies.

CHICAGO DREIS & KRUMP

Press Brakes, Press Brake Dies
Straight-Side-Type Presses

Hand and Power Bending Brakes
Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.
7434 South Loomis Boulevard
Chicago 36, Illinois

es, even dilute acids. Over-all length is 11½ in.; bristle length is 2⅛ or 2¼ in. and bristle width is 1¼, 1½ or 2 in. Prices range from $1.70 to $2.00.

Siline & Johnson, Wapello, Iowa

Lubri-Flo pump for lubrication of machinery and equipment is made to fit 25, 35-lb and 5-gal pails, and makes it possible to apply lubricants in any consistency from the original container to point of application without need for a hand grease gun. Materials that will or will not seek their own level, and lubricants within the NLGI range 0, 1, 2, 3, 4, 5 are easily dispensed under all weather conditions. Unit consists of a high-volume pressure system and a high-pressure pumping mechanism, complete with hose and nozzle assembly.

Force-Flo, Inc, PO Box 2442, East Cleveland 12, Ohio

Worm gear speed reducers with 1/3 to 5 hp input have been added to Hygrade line. Each of the four types —Type S (worm at bottom), Type T (worm at top), Type L (low base vertical output shaft, up), and Type H (high base vertical output shaft, down)—is available in four sizes: 2, 2⅜, 2⅞, and 3⅜-in. center distances. Each size is available in 10-1/3:1, 20½:1, 30:1, 40:1, 50:1, and 60:1 ratios.

Foote Bros Gear & Machine Corp, 4545 S Western Blvd, Chicago, Ill

Straight-sided diesets are available in three different classes matching ASTE classifications. Class A sets are for fast presses, long runs, or heavy dies. Class B are for regular production, moderate press speeds, and/or medium weight dies; and Class C for limited production, slow presses and/or lightweight dies. Details in catalog 580 .

Standard Die Set Co, 1505 Elmwood Ave, Providence 7, RI

Marking machine, floor-type Acromark Model 9AP, gets its operating power from plant airline, 75 psi and up. Open design of back and offset front permits marking of continuous strip, rod, bars. Mouth opening is 14 in. without fixtures, and adjustment is every 2 in. with lock. Width of opening is 15 in. Over-all height is 4 ft 4 in. placing the marking dies at proper position for average hand feeding or production line flow. Width is 24 in., full depth at base is 13 in.

Acromark Co, 7-13 Morrell St, Elizabeth, NJ

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Each of these trademarks on a file is a *guarantee* of satisfaction.

None of them ever appears on a file until our quality control inspectors are satisfied that the file deserves it. It doesn't take much for one of these cold-eyed policemen to turn a file down.

As they guard the reputation of Nicholson, Black Diamond and X.F. Swiss Pattern files, they also protect you. They make sure that these trademarks will live up to their reputation on whatever job you give them to do.

Because we take extra care to make every file just a little bit better, they do a little more for you. And just a small performance improvement cuts filing time in your shop substantially. And that's where a file proves its real worth . . . and the reason why files with these trademarks are at work in more shops than any other.

You can trust these symbols to guide *you* to the best filing results. They've been doing just that for file users and buyers for over 90 years.

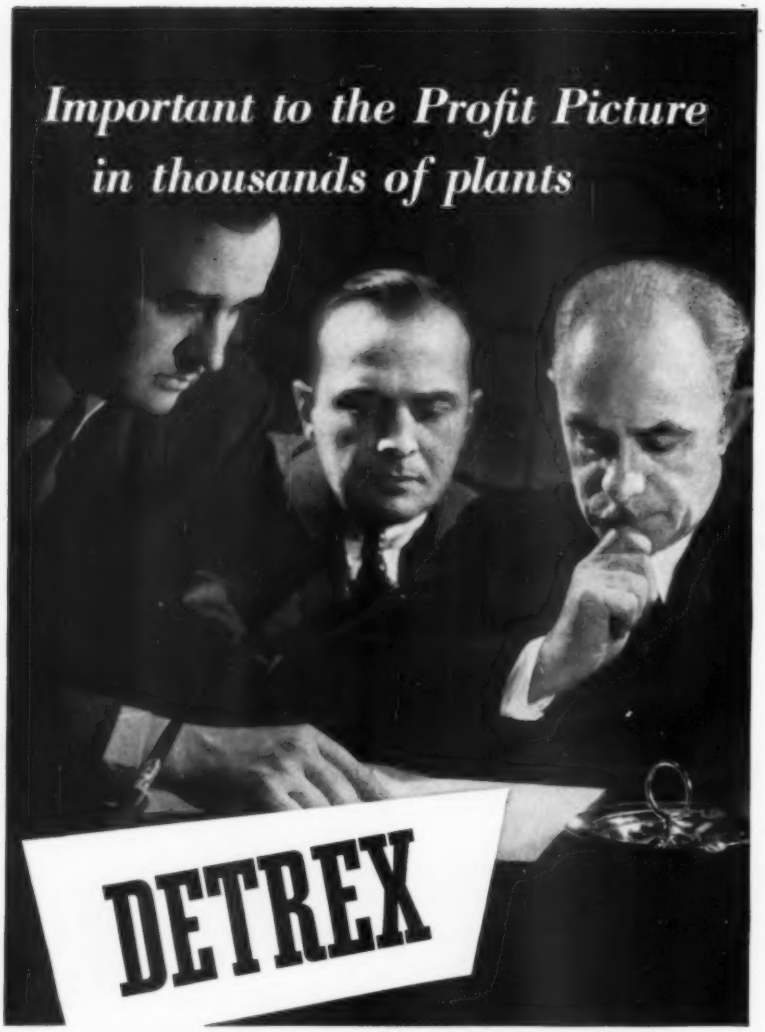
Industrial Distributors provide the finest goods and services in the least possible time. Our products are sold exclusively through them.

"Magicut" All-Purpose Machinist's file. One of 6000 quality files bearing the Nicholson File Company trademark.

NICHOLSON FILE COMPANY, PROVIDENCE 1, RHODE ISLAND
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON and BLACK DIAMOND FILES

A FILE FOR EVERY PURPOSE



• Alkalies • Emulsions
• Phosphate Coatings

From DETREX's full line of alkali and emulsion cleaners you may choose the one that has the precise qualities your operation demands. Whether you need solvency, stability, safety, corrosion resistance or straight cleaning for any metal cleaning operation, a DETREX alkali or emulsion product will fit the need.

DETREX phosphate coatings for paint bonding, rust proofing, cold extrusion and many other finishing processes are reducing costs and increasing quality for thousands of such operations.

DETREX expert technicians and field service men stand ready to help you now. **Write today for full details.**

Depend on DETREX for Every Metal Cleaning and Processing Need

Alkali and Emulsion Cleaners
Phosphate Coatings and Paint Bond Compounds
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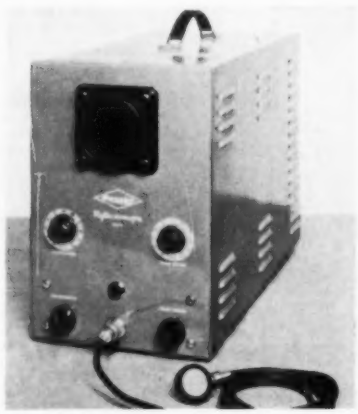
Solvent Degreasers
Ultrasonic Equipment
Industrial Washers
Extrusion and Drawing Compounds
Spray Booth Compounds
Aluminum Finishing Compounds

*PERM-A-CLOR NA is the registered trademark of

DETREX CHEMICAL INDUSTRIES, INC.

BOX 501, DEPT. AM-7, DETROIT 32, MICHIGAN



Portable Reflectoscope Operates at 2.25 mc

Type US weighs 35 lbs, measures approximately 9 in. wide, 19 in. deep, 14 in. high. Controls are simplified to four knobs; single transistorized automatic alarm is readily attached.

Applications include ultrasonic inspection without disassembly of plant machinery, inspection of studs, bolts, welds, forgings. Bulletin 50-136 available on letterhead request.

Sperry Products, Inc, Danbury, Conn

Feeding Device Transports and Measures Metal Powder

A storage hopper large enough to store a day's supply of metal powder, or any other dry, powdered material, is one of the outstanding features of the Bond Feeder. From this hopper, material is transported to the mixer where it is accurately measured in individual batches as desired. These batches can be varied by a simple setting of the control.

Equipment is available for individual materials or for multiple mixing from the same storage hopper. The quantity delivered to each mixer is accurately measured independently of other units. Equipment operates on 110-v, 60-cps current and has an operating air pressure of 6 to 10 psi. The control cabinet is designed for remote installation. The storage tank can be installed above or below floor level and not necessarily in the mixer area.

Hartley Controls Corp, Neenah, Wis

Clamp kit contains all the pieces necessary for clamping work of any size onto machine tool slotted tables or onto bolster or angle plates. Kits are available in two standard sizes, both with ⅝ or ¾-in. T-nuts. Milling machine size will accommodate work heights from ⅜ to 11 in.; boring

mill or plane model will take work heights from ⅜ to 49½ in. Literature available.

Hi-Lo Products Co, 8817 Lyndon Ave, Detroit 38, Mich

Syncro-Snap speed detectors can incorporate up to eight separate speed sensing switches in one aluminum housing that measures 5 in. in dia by 4 in. deep. Each switch controls one circuit which can be actuated by a high speed limit and a low speed limit. Action of the switches is determined by speed alone, regardless of voltage or load. They can be supplied in accuracies of ¼ of 1%.

Torq Engineered Products, Inc, 32 W Monroe St, Bedford, Ohio

Long needle points are available in lengths from ¼ up to 20 in. Variety of point shapes can be ground on all types of ferrous and non-ferrous wires in diameters from 0.020 to ½ in. These parts can have secondary operations performed on them such as primary angle bending, heading, flattening, knurling. Parts are made to customer specifications; some sizes are carried in stock.

Robert A Main & Sons, Inc, 257 Pascack Rd, Paramus, NJ

Nickel Silver Brazing rod, high-tensile Ambraze No. 111, is furnished in five diameters bare (1/16 to 1/4 in.) and four diameters with flux coating (3/32 to 1/4 in.). Recommended for fabrication of small parts, and repair of machine tools, rod can be used in place of costly silver solders and reportedly offers higher strength when more heat is permissible. Melting point is 1700 F; tensile strength, 80,000 psi, shear strength from 150,000 psi.

American Brazing Alloys Co, PO Box 11, Pelham, NY

Locating microscope designed for use in jig borers and similar precision machine tools combines a 25X total magnification with a fairly large field. Eyepiece contains a hairline cross and is adjustable for individual focusing. Standard shanks are ½ in. straight, No. 2 and No. 3 Morse taper. Instrument is of Leitz-Wetzlar (West German) make.

Distributed by Opto-Metric Tools, Inc, 137 Varick St, New York 13, NY

OPL dividing head has built-in indexing accuracy of better than 10 seconds. Points may be re-located and re-set as many times as desired to the same accuracy. Direction of spindle rotation can be reversed at

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. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
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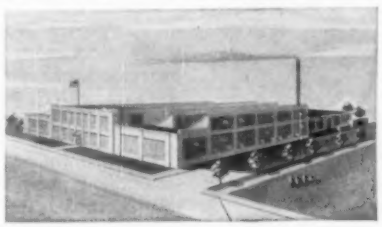

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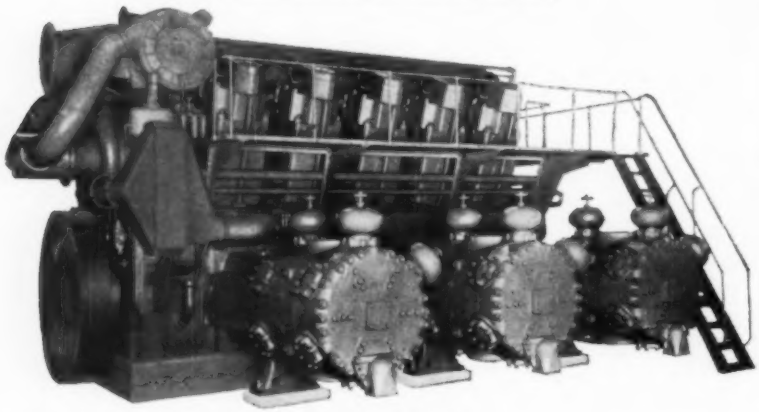
VALVOLINE TECTYL

rust preventives protect Cooper-Bessemer Engines



Large Cooper-Bessemer multi-cylinder, V-angle compressor engine, showing three compressor cylinders.

Tectyl compounds protect vital parts . . .

The crankshaft is the backbone of all diesel or piston type engines. All Cooper-Bessemer crankshafts are protected with Valvoline Tectyl 400-C while in storage or in transit.

The following Valvoline Tectyl Rust Preventives are regularly used by Cooper-Bessemer:

Tectyl 867 —Protects all ground and polished precision parts, such as compressor valve plates, piston pins, bearing shells, etc. . . . also for compressor piston rods being processed for replacement in the field or for storage. The use of Tectyl 867 has reduced expensive production delays due to corrosion.

Tectyl 502-C—A rust preventive, soluble in the engine lubricating oil . . . it is pumped through the lubricating system, thus protecting the crankshaft, bearings, and all the internal lubricated parts of the assembled engine.

Tectyl 400-C—Used for outdoor long term exposures . . . and when preparing engines and compressors for shipment, all exposed, unpainted, machined surfaces are coated with *Tectyl 400-C.*

AM-758

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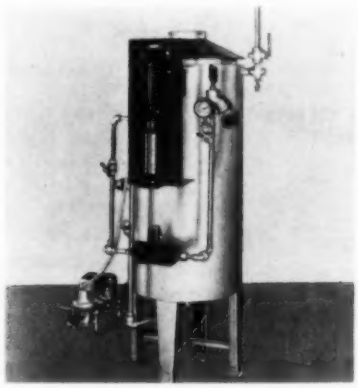
Valvoline Oil Company • FREEDOM, PENNSYLVANIA

Division of ASHLAND OIL & REFINING COMPANY

any time during indexing operation without error. Greatly magnified graduations are subdivided so that extremely close readings, to 2½ seconds, can be obtained directly.

F T Griswold Mfg Co, 315 W Lancaster Ave, Wayne, Penna



Ammonia Atmosphere Generators Available in Three Capacities

Latest additions to company's line of MAX atmosphere generators, these 250, 500 and 800-cfh-capacity units produce a dissociated ammonia atmosphere with residual ammonia content of less than 0.05% and a dewpoint of –40 F.

The alloy steel reaction tube, filled with a special fast reacting catalyst, is suspended vertically in the heating chamber inside a well-insulated casing. The tube is heated by a multi-tube ring-type gas burner that encircles the bottom of the tube and fires vertically into the heating chamber. Burner equipment uses fuel gas at the usual low distribution pressures and ambient air for combustion. Bulletin available.

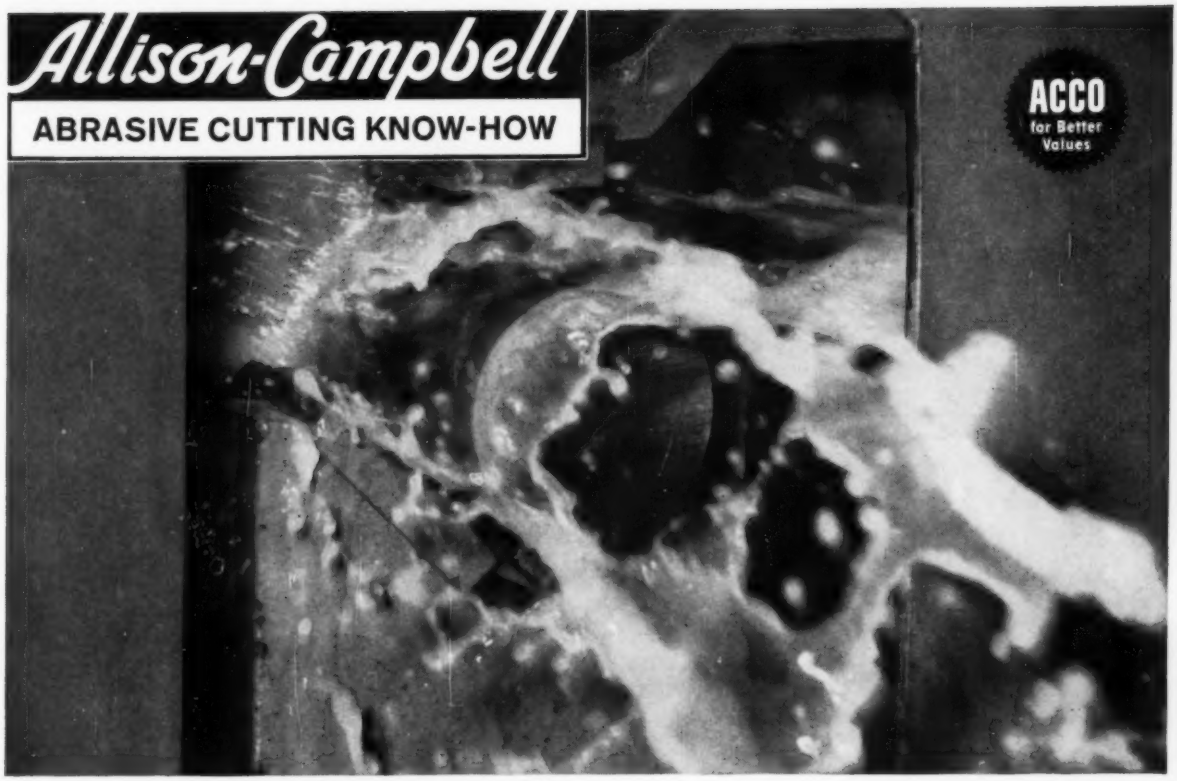
Surface Combustion Corp, Toledo 1, Ohio

Power Roll Design Eliminates Use of Cross or Jack Shafts

New design incorporates use of an individual drive motor for each roll assembly on the power roll. Individual drives consist of ac constant speed squirrel cage motors with variable speed obtained through use of magnetic slip couplings. Driving power is furnished from alternating current. A minute amount of the ac

Allison-Campbell

ABRASIVE CUTTING KNOW-HOW



Proper Use of Coolant Means Better Abrasive Cutting

• Wet abrasive cutting eliminates burning, minimizes burr, and gives a finer finish than any other cut-off method—and the key to this quality is proper coolant application. Here are the three essentials of adequate cooling:

1. Volume of coolant, rather than pressure, must be kept at a high level for maximum wheel life.

2. Coolant must be accurately directed to the *point of contact* between the wheel and the work, because this is the point at which most heat is generated.

3. Coolant must be applied equally to both sides of the wheel to avoid crooked cuts and wheel breakage.

Radial holes in ALLISON wheels carry coolant deep *inside* the cut itself. This extra cooling action assures clean cuts and maximum wheel life on solids from 2″ to 12″ round or square. These holes also impart a self-dressing action to the wheel, keeping sharp grits exposed for cool, fast cutting.

Allison-Campbell Design Assures Proper Cooling

High volume of coolant is provided by a large reservoir and an extra-capacity coolant pump.

Good distribution of coolant is assured by a coolant distributor, standard on all CAMPBELL machines. This can be adjusted and locked in position to provide equal distribution of coolant to both sides of the wheel and to the work.

High-speed, quality cuts on almost *any* material are possible with modern abrasive cutting techniques. Your ALLISON-CAMPBELL Field Engineer will be glad to recommend the right machine and wheels for *your* cut-off jobs. Call on him for help.

A complete selection of machines and wheels for *any* cut-off application is offered by ALLISON-CAMPBELL. Four types of CAMPBELL machines—chop stroke, oscillating, horizontal, and rotary—in capacities from the smallest stock to 14″ rounds . . . billets up to 12″ square . . . plate up to 6″ thick and 20 ft. long. ALLISON wheels—more than 150 different specifications—rubber or resinoid bond—3″ to 34″ diameters—.006″ to 3/16″ thick.

Write for a copy of DH-20, a new bulletin describing the ALLISON-CAMPBELL Demonstration Laboratory, and how you can take advantage of the special services it offers. Complete details on ALLISON wheels and CAMPBELL machines are also available.

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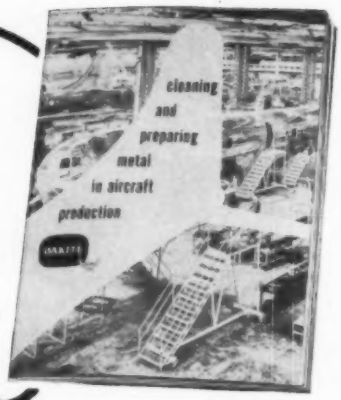

All the tough jobs are covered by Oakite's booklet on *"Cleaning and preparing metal in aircraft production"*. Just check this list of contents for reminders of operations that give you trouble:

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☐ ChromiCoating aluminum before painting	4
☐ Stripping paint from aluminum, steel	5, 9
☐ Barrel finishing aluminum, steel, copper	5, 9, 11
☐ Cleaning magnesium	6
☐ Cleaning steel; derusting and descaling	7
☐ Preventing rust	8
☐ One-operation preparation for painting	9
☐ CrysCoating steel before painting	10
☐ Cleaning copper and its alloys	11
☐ Controlling water in paint spray booths	12

FREE For your copy of this 16-page illustrated booklet, write Oakite Products, Inc., 24 Rector Street, New York 6, N. Y.

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current is converted to dc to operate the magnetic slip clutch by use of a small, inexpensive Thyrotron tube.

Because of constant torque characteristics of this new drive, gear transmissions are said to be practically indestructible. Both motors share the load equally at all times and are remotely controlled from one speed dial on the pendant station. Speeds are indicated on a tachometer, calibrated in inches per minute. If, because of irregularities of a vessel, the load shifts to wheels on one side, the drive motor for this side will automatically increase the torque to maintain pre-set welding speed. All work can be positioned on a common vertical centerline.

Pandjiris Weldment Co, 5151 Northrup Ave, St Louis 10, Mo

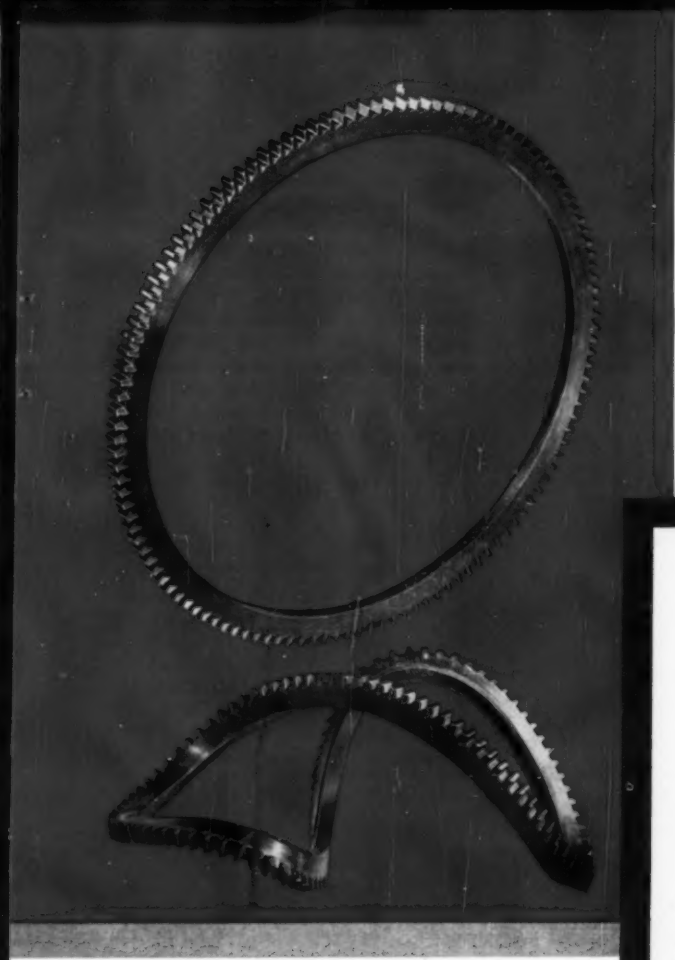
Daisy blind rivet, made of steel, is available in two lengths. Each size has a 7/16-in.-dia washer collar. One size has a $\frac{5}{8}$-in. split sleeve length and a 0.032 to 0.250-in. grip range; the other has a $\frac{7}{8}$-in. split sleeve length and a 0.032 to 0.375-in. grip range.

Huck Manufacturing Co, 2480 Bellevue Ave, Detroit 7, Mich

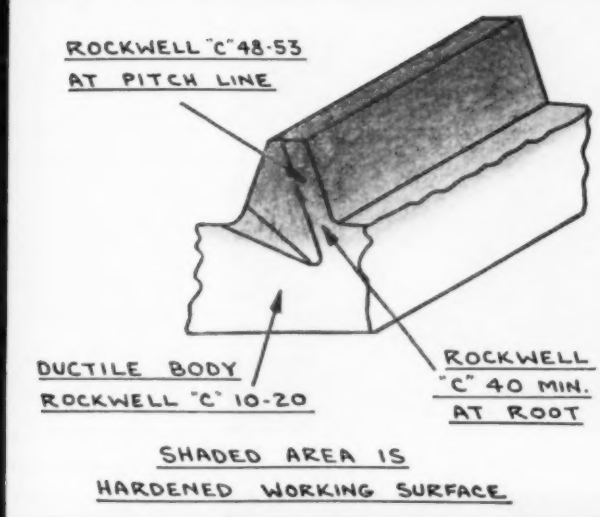
Conveyor system, the Cable-Link Conveyor, incorporates links of preformed wire rope in multiples of 8 in. Trolleys, turns, and vertical dip wheels can be combined to offer max movement in either vertical or horizontal direction. Units are standard in 8, 16, 24-in. lengths. Components can be used to replace existing chain conveyors; monorails and supporting structure are retained, drive wheels and turn wheels are replaced.

Dearborn Fabricating & Engineering Co, 19440 Glendale Ave, Detroit 23, Mich

"You're not only late—you're reporting to the wrong company."



THIN! TOUGH! ...and "tender-hearted"



THE MANUFACTURE of flywheel ring gears poses special problems. Sectional thickness is usually less than three-quarters of an inch. To withstand the impact force of the starter pinion, the gear teeth must be hard. But the gear body itself should be unhardened so that it will conform tightly to the flywheel, and "give" under the stress that might snap a brittle gear.

Note how DOUBLE DIAMONDS are made to be thin, tough, "tender-hearted." The above photo of a gear twisted into a pretzel shape graphically demonstrates ductility. The sketch at right shows three important areas: the wide and deep hardness pattern, the generous area of transition, and the ductile body. These extremes are achieved in DOUBLE DIAMOND Flywheel Ring Gears by controlled selective heat treatment—all essential to flywheel ring gears that provide the best possible performance.

Our Engineering Department will be glad to make constructive suggestions on the design of flywheel ring gears, or on the many other types in which we specialize. Write, phone or wire—depending on the urgency of your need.

EATON

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MANUFACTURING COMPANY
RICHMOND, INDIANA

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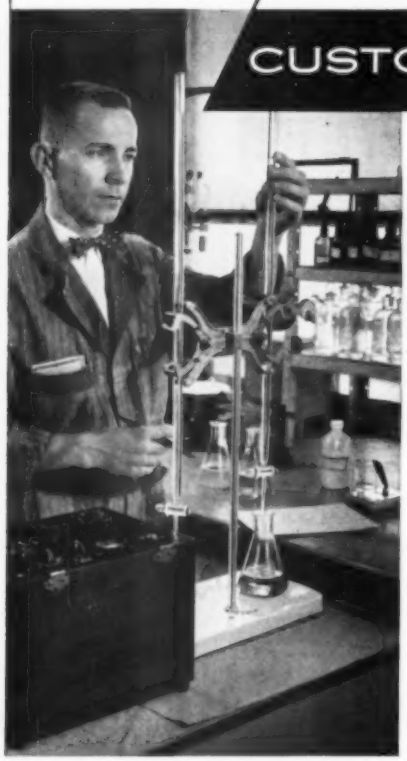

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In the Roto-Finish Laboratory, technicians analyze your problem to determine the process which provides the desired finish at minimum cost. Often, it is necessary to develop a new compound to meet a specific need.

Test runs are then made in the Roto-Finish Processing Department under production conditions. If desired, your local Roto-Finish Customer's Man will run these tests in your own plant; so that you can check the results at first hand, results like this...

Roto-Finish CASE HISTORY

PART: Refrigeration compressor flapper valves. • MATERIAL: Swedish steel. OPERATIONS PERFORMED: Deburr. Generate full radii on all edges. Remove stress risers. • RESULT: Fatigue resistance increased 500%.

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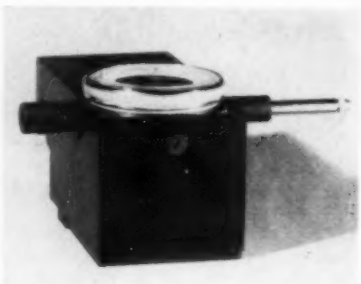
NEW SHOP EQUIPMENT

Diaphragm chuck, SC 401, is designed for high speed precision boring or grinding on single and multiple spindles. Recommended part range is from ⅛ to 3 in. dia. Air-operated unit, 4⅞ in. nominal dia, reportedly will assure consistently controlled concentricity at spindle speeds up to 5000 rpm. Standard stocked item has three adjustable jaws and fixed stop facilities. Flange adapter is furnished for faceplate application.

N A Woodworth Co, Sales Div, 1300 E Nine Rd, Detroit 20, Mich

Shaft-mounted speed reducers with capacities from ¼ to 40 hp incorporate Duti-Rated lifetime gearing, and are offered in single and double reductions with output speeds from 10 to 420 rpm at 1750 rpm input using standard V-belt drives. Units are available in shaft sizes from 1 7/16 to 3 7/16 in.

Foote Bros Gear & Machine Corp, 4545 S Western Blvd, Chicago, Ill



Tone-Emitting Dial Indicator Warns of Lathe Feed Shutoff

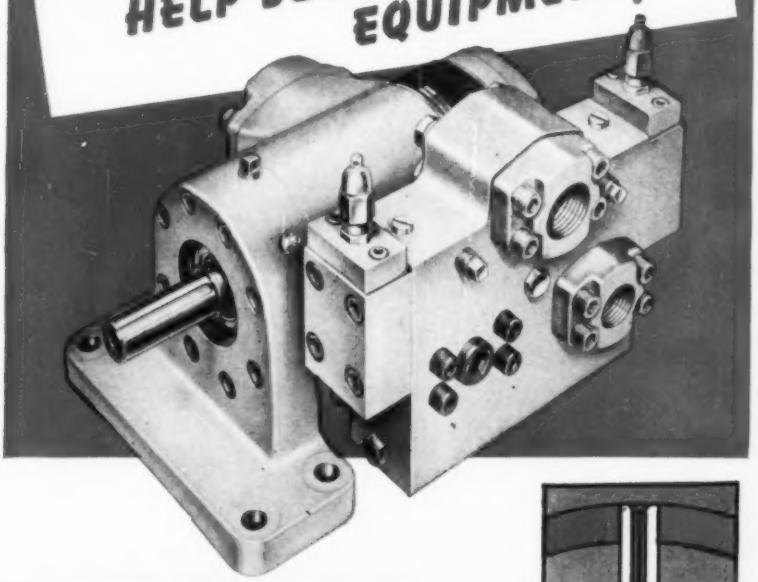
Device, containing a transistorized circuit, warns lathe operator before point of feed shutoff is reached. Sound generated is of a frequency above that of shop noise level, and of great enough volume to be heard within a radius of 30 ft in the average shop. Tone emission continues for approximately one-hundred thousands of indicator sweep, providing adequate notice of shutoff time.

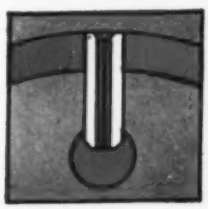
Adjustable control is located on the case to provide for presetting of tone emission starting time at any desired point on the indicator. Power is supplied from four penlite batterise which, under average use, will reportedly last for several months. Clamping mechanism is designed to adapt to any lathe with V-type ways. Accessory bracket provides for cross-feed application.

La Fan Co, 1956 S Earlington, Duarte, Calif

Consider HYDRECO Dual-Vane Double Pumps with Valve Panels from the Standpoint of Their Ability to—

HELP SELL YOUR EQUIPMENT!





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HYDRECO Dual-Vane PF-100 Series Double Pumps with combination relief and unloading valves provide high circuit flexibility through either automatic or external pilot control. For example . . . in a "hi-lo" circuit, large volume delivery is available for a fast traverse cycle. Then, during the feed cycle, when small volume is required, one pump section unloads automatically . . . saving dollars in horsepower! These pumps can also be operated on separate circuits . . . each circuit protected by its own relief valve.

Dual-Vane Pumps can operate *continuously* at 2000 psi and up to 1800 rpm. Their exclusive "Dual-Vane" feature and advanced design combine to assure long, trouble-free performance and maximum simplicity in servicing. Thus, they are a natural choice for a wide variety of high production equipment, including: Machine Tools, Hydraulic Presses, Die Casting and Plastic Moulding Machines, Closing and Clamping Devices and other functions calling for controlled variation in Pump volume.

TWO VANES ARE BETTER THAN ONE

The hydraulically counterbalanced DUAL-VANES in these HYDRECO Hydraulic Pumps eliminate wear-producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive HYDRECO feature.

Member NFPA

The PLUS factors in HYDRECO Dual-Vane Pumps weigh heavily at the sales end—so, WRITE . . . get the facts on Dual-Vane Hydraulic Pumps and Fluid Motors.

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WHITE ROCK, B.C.—Stratoflex of Canada, Inc., 13677 Marine Drive

Kalamazoo Division
The New York Air Brake Company
9001-7 East Michigan, Kalamazoo, Mich.

Please send me Bulletin DP-308C fully describing HYDRECO Dual-Vane Double Pumps with Valve Panels.

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Company_____

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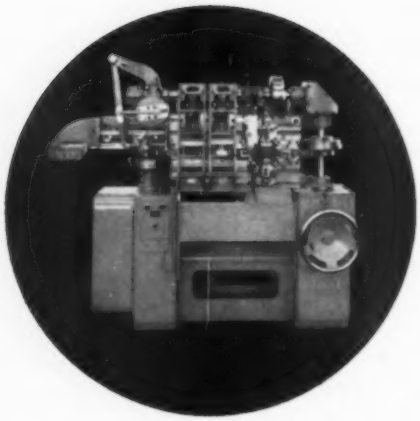
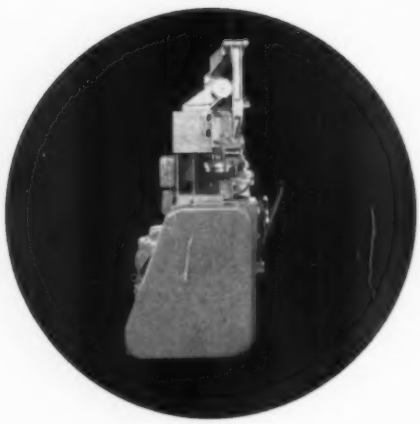
City_____ Zone____ State_____



VERTICALITY = SETUP TIME / 2



The big story of the important new line of Torrington vertical 4-slides is savings:

Upward of 50 percent savings in setup time, tooling costs and floor space!

On a strict cost-accounting basis, you cannot afford not to investigate the profitability of replacement with the Torrington "Vertical Line" in the cost-critical field of wire and strip forming production equipment. Full data—or a demonstration—upon request.

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FIELD REPORT...

Goodyear Building Sea Missile

Goodyear Aircraft Corp, Akron, has a $65 million contract from the Navy to develop the Subroc, a rocket-powered missile launched from a submarine on or below the surface. Weapon's system detects an enemy sub at long range, computes its course and speed, and fires the missile.

US Chemical Milling Contract

The Manhattan Beach, Calif, company has been awarded the largest contract to date for chemically milled parts for Convair's supersonic B-58 jet bomber. Order, in excess of $1.5 million, calls for manufacture of wing skins. The B-58 is currently in production at Convair's Fort Worth, Texas, plant.

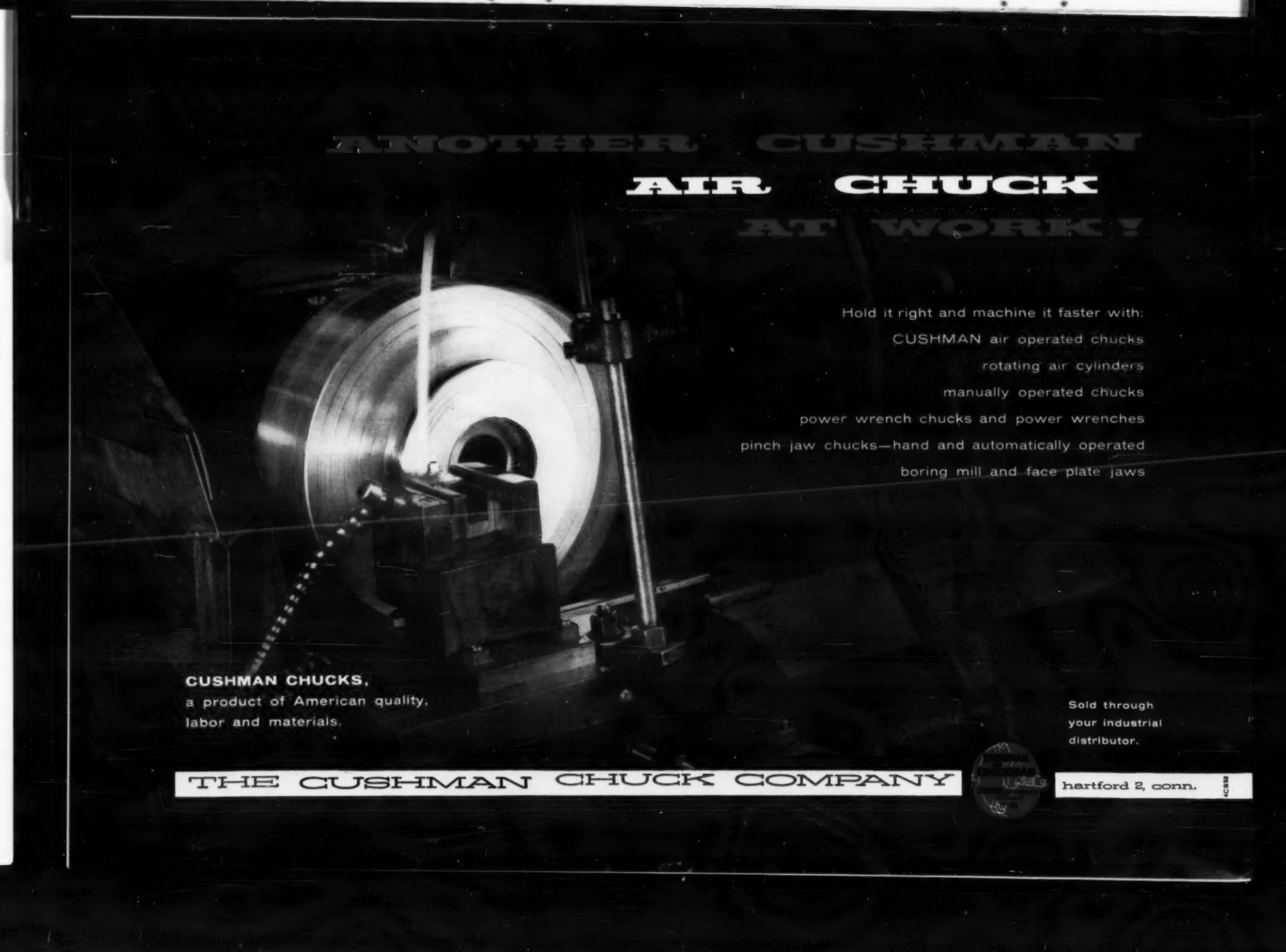
Havir Buys Diebel Press Line

Havir Manufacturing Co, St Paul, Minn, has acquired the line of Diebel Hi-Production automatic metal stamping presses made by Di Machine Corp of Chicago. Sales will be handled by the Sales Service Machine Tool Co, St Paul, which also handles Havir's Press-Rite presses and Shape-Rite shapers.

States Steamship Co to Build Three New Mariner-Type Ships

The San Francisco company has asked the Federal Maritime Board to subsidize construction of three ships, expected to cost about $14.5 million each. Under terms of the

"If I tell you how I just ruined that new $25,000 piece of machinery, will you promise not to laugh?"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A RUTHMAN

GUSHER Coolant Pumps

There is a type and model of Ruthman Gusher Coolant Pump to fit virtually every requirement; Immersed Type, Pipe Connected, Flange Mounted, and Shaft or Pulley Driven. Precision built of the best materials, Gusher Pumps offer you very distinct advantages. The shafts are electronically balanced to reduce vibration and wear. There are no seals to require constant replacement. No packing or priming is needed. Capacities from 1/30 to 7½ H.P.

Model UL

PUMP for every

GUSHER Tank Units

Offering you great versatility of movement; Gusher Tank Unit Coolant Pumps can either be mounted permanently on metal-cutting machines without built-in coolant tank, or can be equipped with casters for complete portability. Every metal working plant—large or small—should have a Gusher Tank Unit for emergencies. Capacities 1/30 to 7½ H.P. 4 gal. tank capacity and up.

Model 9050
Tank 22-4808

APPLICATION

RUMACO Seal Pump

Precision built Rumaco Pumps offer you the same advantages built into all Ruthman Pumps. A seal type pump, the Rumaco can be mounted anywhere. Rumaco pumps are adaptable to a wide variety of applications where a centrifugal pump is needed. Capacities 1/10 to 7½ H.P.

Model 5-3

Before you buy — compare our quality . . . prices.

Write for catalog

THE Ruthman MACHINERY CO.

1819 Reading Road, Cincinnati, Ohio

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

Field Report . . .

line's subsidy contract with FMB for operation of its fleet, it must let construction contracts for the three ships by Jan 1, 1960, but company hopes to beat deadline by as much as a year. Vessels will take 1½ to 2 years to build. Line expects to replace its entire 13-ship fleet by 1972 through a $150 million shipbuilding program which will start with the three now awaiting subsidy approval.

Solar Aircraft, San Diego . . .

. . . has $10 million in orders for ground support equipment for commercial and military aircraft including the Convair 880, Douglas DC-8, RB-58, RB-66, and P-6M.

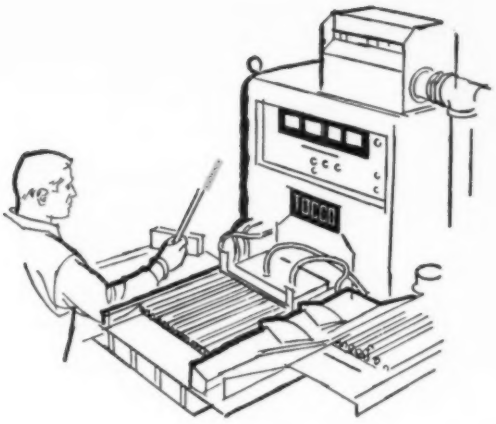
Amana Refrigeration Inc Ups Production Schedules

The Amana, Iowa, firm reports that "because air conditioner sales have shown a 48% increase and freezer and refrigerator sales are up 10% this year" they are beginning a six-day work week with nine hours Monday through Friday and a half day on Saturday.

Eaton-Fuller Merger

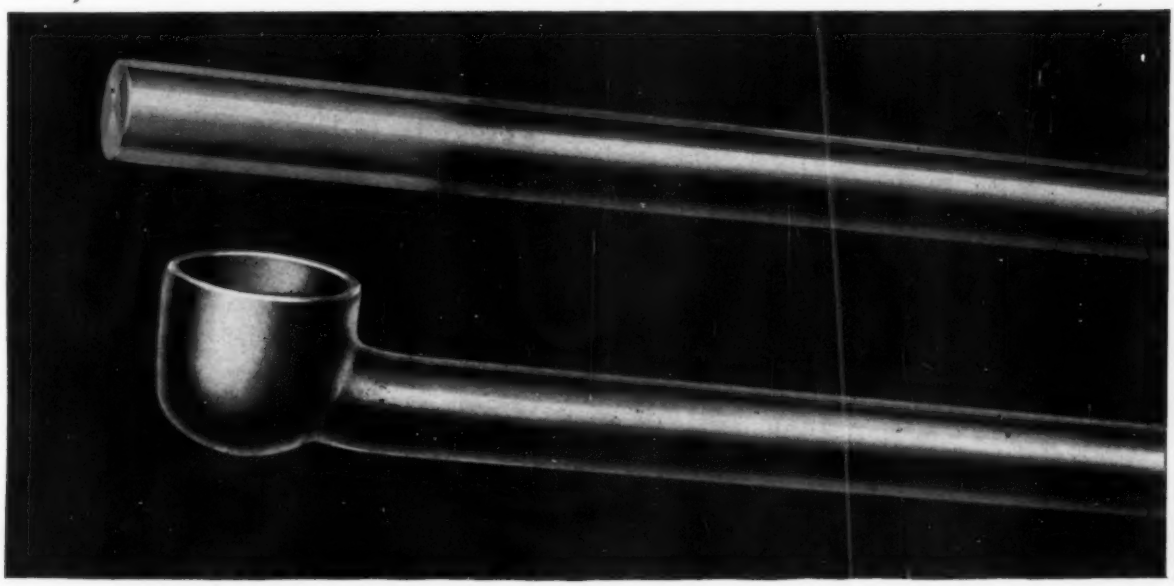
Eaton Manufacturing Co, Cleveland maker of parts and equipment for the automobile, aircraft, machine tool and other fields, plans to acquire the Fuller Manufacturing Co, Kalamazoo, Mich, producer of transmissions, axles, and clutches for cars and farm equipment. Directors of both companies have agreed on a share-for-share exchange of stock; shareholders will vote on proposal

"I wouldn't say you're slow, Findley. It's just that by the time you finish a part, it's obsolete."



Heating Costs Cut In Half

with TOCCO* *Induction Heating*



Engineers at Thompson Products Inc.'s Michigan Division recently changed from gas-fired furnaces to fully automatic TOCCO. Application: heating for forging of automotive tie rods. Result: a substantial reduction in direct labor costs, saving thousands of dollars a year on this heating for forging operation. *Annual savings actually amortize the cost of the TOCCO installation in about one year.*

The automotive tie rod shown here is only one of over 500 parts heated for forging in Thompson's new, modern forge plant. *Every one of these parts is heated with TOCCO equipment.*

If *your* manufacturing operations require heating for forging, heat treating, brazing, soldering or melting, it will pay you to investigate TOCCO as a sound method of increasing production and lowering costs.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. B-7, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Heating for Forging and Forming".

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

12 NEW ¾" and 1"
Norgren AIR LINE FILTERS
Make Norgren the most complete line available!

For ¼" through 1½" Pipe Sizes
Up to 300° F Operating Temperature
Norgren
Removable Bowl
5 to 250 psi Operating Pressure
Automatic or Manual Drain
Highly Efficient Water Removal

REDUCE COSTLY WEAR ON YOUR AIR EQUIPMENT

...with Norgren Air Line Filters

- **Now, 98 Models to choose from**—¼", ⅜", ½", ¾", 1", 1¼" and 1½".
- **Abrasive Solids and Corrosive Liquids** are removed from air lines, reducing equipment wear, repair and replacement costs.
- **Transparent or Metal Bowls**
- **Choice of 4 Filter Elements**—74, 64 or 25 micron...5 micron available in some sizes.
- **Automatic or Manual Drain**

For complete information about Norgren Air Line Filters, call your nearby Norgren Representative listed in your telephone directory—or **WRITE FOR No. 900 CATALOG**

If it's Norgren...It's Dependable.

C. A. NORGREN CO.

3436 SO. ELATI STREET • ENGLEWOOD, COLORADO

Field Report . . .

at a July 30 meeting. Fuller has two transmission plants in Kalamazoo, an axle plant in Louisville, and a drop forge division in West Allis, Wis.

Lewyt Mfg Corp Orders

The Long Island City, NY, firm has a $2.5 million AF contract to manufacture transistorized indicators for use in conjunction with the SAGE program. Another contract, from the Signal Corps ($1.2 million) calls for production of high speed communication equipment. Orders will provide 80,000 man hours of work for the next two years.

Lockheed Aircraft Reports . . .

. . . almost $3 million in new contracts. The Burbank, Calif, company has a $2.5 million order from Air Materiel Command for instrumentation and flight testing of the F-104B, and a $400,000 contract for T-33 aircraft.

Siegler Contract Expanded

Orders for Siegler Corp's magnetic amplifier autopilots for Martin Co, Baltimore, have upped the original contract to more than $1,460,000 with a new $560,420 add-on order. Autopilots are for use in the Mace missile. Work is being carried out at Siegler's Hallamore Electronics Div, Anaheim, Calif.

US Industries Forms New Group

New Military Systems Planning Group has been set up to guide and coordinate resources and facilities of the fifteen specialized USI divisions on research, development, and production of military systems. It'll con-

"He's been out of work for five weeks now, and it preys on his mind."

you can get

This A.S.T.E. exhibit showed visitors how the winning combination that matches machine, work and cutters was found for companies like yours

the winning combination!

Write for this new book which tells more about this unusual Cutter Division service. It also describes and illustrates the standard and special inserted blade cutters being used by hundreds of companies to cut costs and improve performance.

The Key to Lower Cost Chips is found by matching the *right* cutter to the machine and to the work.

The Cutter Division of The Ingersoll Milling Machine Company offers you a unique source of assistance. The combination of *your own* knowledge of conditions in *your* shop and our broad experience in working with so many others assures reduced costs and better cutting performance for *you*.

No matter what make of machine you use for milling or boring —no matter what metal or size or shape of piece—this service may lead to important competitive advantages. You have much to gain . . . nothing to lose by giving us an opportunity to study, with you, in your shop, the many factors involved in arriving at the winning combination *for you*. Just let us know when it would be convenient to get together. Write to: K-78

CUTTER DIVISION

THE INGERSOLL MILLING MACHINE COMPANY

505 FULTON AVENUE ROCKFORD, ILLINOIS

we took the puzzle out of jig boring

with the

DIXI 60

horizontal optical jig borer

Made in Switzerland
Measurements in Inches

The only horizontal jig borer that combines the accuracy of the vertical spindle with the versatility of the horizontal spindle.

DIXI 450 Optical Precision Rotary Table

ACCURACY: Optical settings provide an overall accuracy of .0002".

VERSATILITY: The combination of the Dixi 60 and the Dixi 450 precision optical rotary table (illus.) permits jig-less boring, facing, milling and drilling work in all planes and compound angles between them with optical interrelationship all in one set-up.

PRODUCTIVITY: A complete optical setting including unclamping, positioning, fine adjustment, reclamping and rechecking takes less than 10 seconds. Convenient and functional controls eliminate idle machine time.

The DIXI Optional Reversing Process assures perfect alignment in work pieces with line bores, as well as round, taper-free holes. Get all details on this process by writing for illustrated catalog.

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.— Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the Dixi 60.

MBI

M.B.I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery"

Field Report . . .

centrate on ground-based, ship-borne, and air-borne detection and surveillance subsystems; handling and launching systems for missiles and other space vehicles; automatic electronic checkout and auxiliary equipment for weapons and space systems.

Chemetron Corp . . .

. . . has taken over Allbright-Nell Co, manufacturer of meat packing machinery and equipment. Both firms are headquartered in Chicago. A-N will be operated as a subsidiary of Chemetron (formerly National Cylinder Gas Co) and will coordinate its production and sales with Chemetron's Girdler Process Equipment Div, Louisville, Ky.

Mercast Manufacturing Co . . .

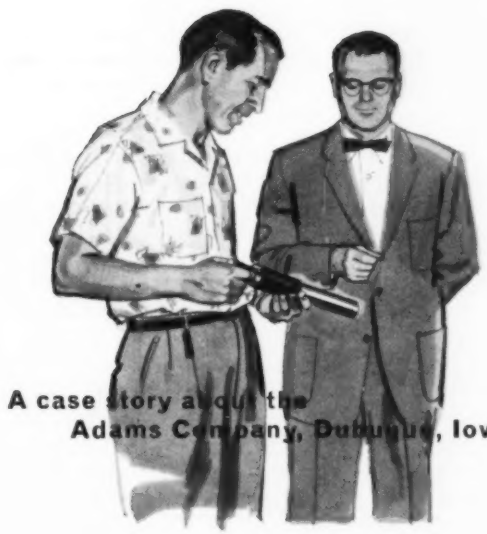
. . . will undertake development of foundry control practices and techniques to better utilize high strength steel casting in aircraft. Program is being carried out under a contract from Chance Vought, Dallas, and is being sponsored by the Air Materiel Command. Mercast, La Verne, Calif, affiliate of Atlas Corp, will accumulate data on steels to be used in temps up to 1000 F and in strength levels up to 260,000 psi.

American MARC's Backlog . . .

. . . has increased since Jan 1 from a total of $1 million to $3.3 million. Latest contract awarded to the Los Angeles firm is a $700,000 order from Libby Welding Co, Kansas City, Mo.

Bob showed them a new product that ended rust on work and tools—

STANDARD Special Transparent Coolant



A case story about the Adams Company, Dubuque, Iowa

Before Standard Oil lubrication specialist Bob Wenger told The Adams Company management about Standard's SPECIAL TRANSPARENT COOLANT, there had been considerable trouble with rusting of work and machines in the plant. There had also been trouble with deposits on the ways of the grinding machines. Rust occurring on parts being processed was resulting in damage and even losses. This has been changed.

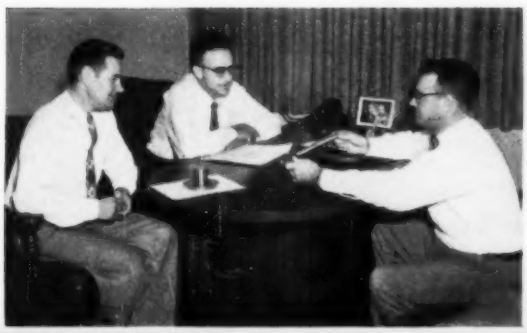
"Since we changed to your SPECIAL TRANSPARENT COOLANT, we have not had any rusting or deposits on our machine tools, and this product has eliminated the rusting problem on parts being processed through our plant," says Harlow Adams, president of the company.

The Adams Company found they received important additional benefits as well. Operators could now see their work clearly. There was less wheel loading. Because the coolant didn't foam, more of it stayed on the wheel resulting in cooler operation. Faster cuts were obtained with finer wheels. Finer wheels gave better finishes. Periods between dressings were extended. Tolerances were maintained.

Research, development and more than two years of field testing have gone into Standard's SPECIAL TRANSPARENT COOLANT. This is the pay-out to you on the research done by Standard Oil to bring you better metalworking products. Find out more about Standard's SPECIAL TRANSPARENT COOLANT. Call your nearby Standard Oil lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about
Special Transparent Coolant

- Clear, transparent fluid.
- Able to control corrosion and rust on work and machines.
- All chemical. Does not support bacteria growth.
- Unaffected by humidity.
- Nonfoaming.
- Fire resistant.
- Odorless.



No rust. Shaft ground with Standard's SPECIAL TRANSPARENT COOLANT shows no rust on inspection by A.T. Murphy, General Superintendent, Harlow Adams, President, and Bob Wenger, Standard Oil lubrication specialist.

You expect more from STANDARD *and get it!*

One hand moves it EASILY!

THE WELLS MODEL **49A**

"2 IN 1" METAL CUTTING BAND SAW
WITH **WHEELS** AND **HANDLE**
(Optional Equipment)

We've taken our popular Model 49A . . . put it on heavy duty, rubber tired, ball bearing wheels . . . added a smooth one piece fold-down handle. Here's a metal cutting band saw that's REALLY MOBILE . . . that can be wheeled wherever needed . . . quickly . . . easily.

The Wells Model 49A is a dual purpose saw. As a horizontal cut-off machine, it has a capacity of 3½" x 6". Swing the head into vertical position . . . it becomes an upright band saw for cutting angles, slots, notches, bevels and contour work.

The wheel and handle unit is optional equipment, available both for new machines and those already in service. The modest cost will be repaid many times over in time and labor savings. Your local Wells Distributor can give you the details . . . or if you prefer, write for Bulletin 253-H.

Wells Saws
Wells ®

The Pioneers of Horizontal
METAL CUTTING BAND SAWS
WELLS MANUFACTURING CORPORATION
505 Roosevelt Road, Three Rivers, Michigan

Field Report . . .

for 1700 permanent magnet generators which will be attached to American MARC diesel engines that supply power for Defense Dept mobile and permanent electronic installations.

Saco-Lowell Shops Plans . . .

. . . to transfer additional operations from Maine into the Carolinas. The Boston-based manufacturer of textile machinery and automotive parts will add 25,000 sq ft to both its Sanford, NC, and Easley, SC, plants.

Lindberg Steel Treating Co . . .

. . . has acquired the processing facilities of the flame hardening department of the Metal Improvement Co of Los Angeles. Facilities have been integrated into the selective heating division of Lindberg's Los Angeles branch and will provide additional productive capacity for selective heating services by the oxy-acetylene method.

Hoover Ball & Bearing . . .

. . . stockholders will vote this month on a proposed merger with Uniloy Corp, Saline, Mich, tool and die concern. Terms of the merger provide for an exchange of stock. Hoover has been the principal customer of Uniloy in recent years.

Tomkins-Johnson Tripling Space

New manufacturing plant and office facilities are being constructed on a 13-acre site near Jackson, Mich, for

"No, I'm not on any team. I work for the company."

facts about LEDLOY* FREE-MACHINING STEELS

The Inland process of adding lead to any steel improves machinability from 25 to 50% without affecting mechanical and metallurgical properties

Ledloy is Inland Steel Company's trade name for any grade of steel to which lead has been added to obtain greater machinability. Inland regularly produces Ledloy free-machining open hearth steels to a wide variety of chemical specifications to meet customer requirements. In each instance, regardless of the chemical composition, *the addition of lead by the Inland process results in no significant change in the desirable mechanical and metallurgical characteristics of the steel.* All the important qualities of open hearth steels, such as ductility, impact values, transverse strength, case hardening qualities and cross sectional soundness are retained. Any heat treating, or forging operation that can be performed on similar non-leaded grades of open hearth steels *can be performed* on Inland Ledloy free-machining steels.

What is affected, and to a marked degree, is machinability! Though Inland Ledloy steels contain only about one-quarter of one percent lead, distributed evenly throughout the steel, this small quantity of lead does amazing things to the steel's machinability. On-the-job use consistently shows cold drawn Ledloy can be machined 45% faster than B1113 and 100% faster than B1112. Surface speeds of 325 feet per minute are common and much higher speeds are possible; up to 450 sfm with high speed tools and up to 600 sfm with carbide tooling.

Not only is speed increased, but down-time for tool changes is markedly reduced. The reason is that Inland's process of adding lead to steel lowers the steel's friction component and actually lubricates the cutting tool during machining. Less heat is generated, tool-edge build-up is minimized and tool life is increased considerably.

Ledloy steels' shorter-length chips generally fall clear of the tool and Ledloy's lubricant characteristic aids in preventing chips from welding to the tool.

Ledloy steels are especially clean-cutting and machine to a fine, smooth finish — smoother than that obtained with other free-cutting steels—making dimensional tolerances easier to maintain. In practically all cases, Ledloy steels may be fabricated—sheared, bent, formed, torch-cut, welded, brazed—in the same manner used for steels of the same base chemical composition and with equal or better results.

Many grades available—Inland Ledloy free-machining steels are available in a wide range of standard carbon and alloy grades in bar form. Ledloy free-machining plates are also produced.

If your product requires machining, it will pay you to get all the details on Inland Ledloy . . . the original leaded steel. Ask your cold-drawer about it today, or write Inland Steel Company, 30 West Monroe Street, Chicago 3, Illinois, for the interesting booklet, "Properties of Inland Ledloy Steels."

INLAND STEEL

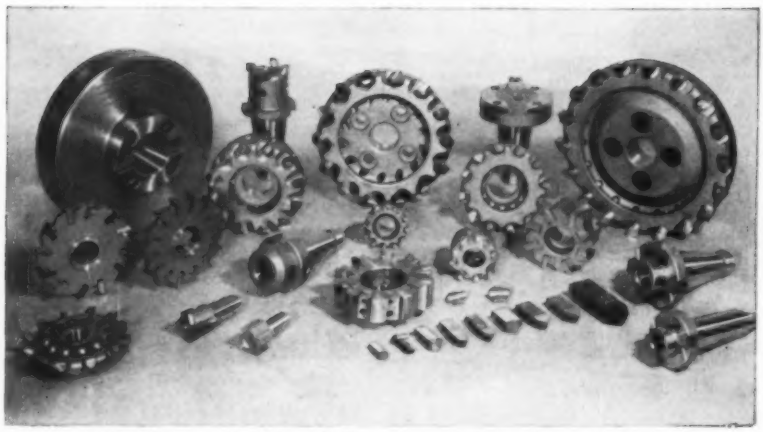
Sales Offices: Chicago • Milwaukee • St. Paul • Davenport St. Louis • Kansas City • Indianapolis • Detroit • New York

INLAND

Ledloy Steels

the world's most machinable

*Reg. Trade Mark



Milling Cutters — End Mills — Blades — Boring Tools — Arbors — Flywheels

These Lovejoy Products can help you Cut Costs!

The entire line of Lovejoy Milling Cutters and Accessories is designed to aid you in getting better production at less cost.

If you are not now using Lovejoy products, we invite you to do so at first opportunity.

Lovejoy precision-engineered tools include:

Inserted-tooth milling cutters (face, side, end, slotting and boring) which feature husky, forged steel housings; exclusive Lovejoy "positive-locking" blade assembly; a variety of dozens of models and hundreds of sizes.

Blades: H.S.S., Vasco Supreme and carbide. These are interchangeable over a wide range of housing sizes, and Type "A" face milling blades will fit any standard Lovejoy Type "A" cutter of 4½" to 24" dia. All Lovejoy blades are carried in stock, ready for immediate shipment. Special cutters are a Lovejoy specialty.

PERFORMANCE REPORT

A Type H "SHEARJOY" cutter (with 35° lead angle) was used recently to reduce a 11,070 lb. casting to 3400 lbs. The cutter ran 18 straight hours without regrinding. Cutter condition after using was excellent. Owner's comment: "This is the cutter I've been looking for for a long time . . . if we had this cutter 10 years ago, we would have saved $50,000 . . . it's the most impressive cutter I have ever seen."

Catalogs — include: "Face Mill Catalog No. 31; Side Mill Catalog No. 32; Type "S" Bulletin; Arbor Catalog No. 33; "Speed and Feed" Calculator. Write today for copies desired.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U.S.A.

Field Report . . .

Tomkins-Johnson, manufacturer of air and hydraulic cylinders and control valves, milling cutters and reamer tools, and riveting and clinching machines. Plant is scheduled to be in operation by year's end, when employment force will be substantially increased.

$3 Million Contract to Sperry

Order to develop and produce all-altitude flight control systems for the Navy's F8U-3 fighter now under development by Chance Vought has been received by Sperry Gyroscope. Automatic pilot system will incorporate new design concepts to enable the pilot to maneuver the jet interceptor precisely at speeds more than twice that of sound.

Chain Belt Expanding

The Milwaukee company has bought 92 acres of land in Madison, Ind, to provide additional manufacturing capacity for its heavy machinery lines. Construction of a new plant, scheduled to start shortly, will permit consolidation of the company's present manufacturing operations now located in Niles and Newton Falls, Ohio, and Rock Island, Ill.

National Steel Acquisition

National's Weirton Steel Division has purchased Crown Cork & Seal Co's cold reducing mill and supplementary equipment for manufacture of electrolytic tin plate. Equipment, located at Crown's Baltimore plant, will be utilized in the Weirton Division operations.

"I just wish I could muster a bit more confidence in our instructor—"

ROCKWELL-BUILT

DELTA 20" DRILL PRESSES

Multiple spindle set-ups
do the work of machine tools costing twice as much

Making heavy-duty staplers and industrial stitchers calls for precision drilling operations and production line ruggedness. At Bostitch Inc., East Greenwich, R. I., five multiple spindle Delta 20" drill presses (6 spindles each) work alongside machine tools costing twice as much. And, according to John Larke, Chief Methods Engineer, "Delta fills the bill at surprisingly low cost."

COST CUTTING EXTRAS offered by these versatile Delta tools include five speeds, easy "up front" speed changes and independently powered spindles for greater protection against downtime due to motor trouble.

"CATALOG ENGINEERING—buying Delta tools by components instead of complete units—gave us production tooling to meet our exact needs," says Mr. Larke. Using six 20" Delta spindle heads mounted on a standard 17" drill press production table minimizes work transfer operations and saves valuable floor space.

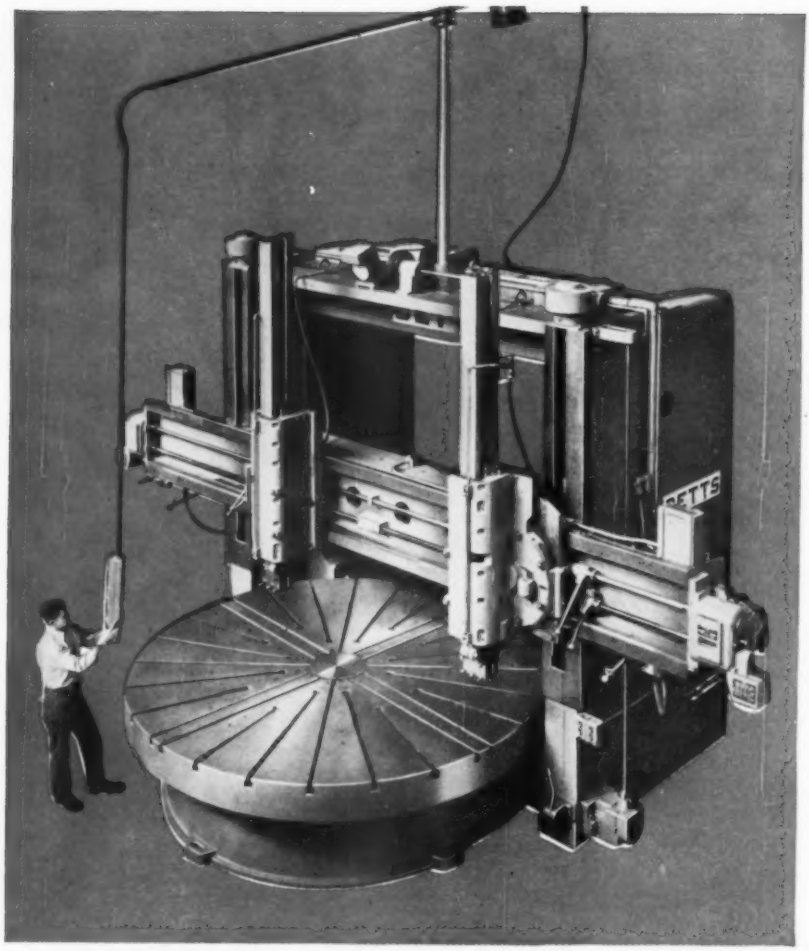
See Delta drill presses and a complete line of industrial metalworking tools and accessories at your nearest Delta Dealer . . . he's listed under "TOOLS" in the Yellow Pages. Choose from the WORLD'S MOST COMPLETE LINE of drill presses: 20", 17", 15", 14" and 14" Super-Hi Speed in floor, bench and overhead models.

Learn how YOU can cut costs with Delta Industrial Tooling—write for FREE Drill Press Catalog to: Rockwell Mfg. Co., Delta Power Tool Div., 618G N. Lexington Ave., Pittsburgh 8, Pa.

DELTA POWER TOOLS

another fine product by

ROCKWELL



ACCURACY

plus ease of operation... in a 12-foot boring mill

The Betts® 12′ vertical boring mill is just what your production operation needs. This machine brings a new degree of accuracy, convenience and capacity to boring and turning jobs.

The new Betts mill is designed to give you simplicity of operation. Simplified controls reduce maintenance and provide smooth, uncomplicated performance. It's rugged too. Steel rams and replaceable bronze liners give the added degree of rigidity necessary for those tough production runs. This is typical of the keen attention to construction details found in every Betts mill.

The table turns on an antifriction bearing, a construction that requires less power and enables you to handle heavier work loads. It is arranged for variable - voltage, adjustable - speed motor drive. Feed rate is .003″ to .500″ per revolution of table. Speeds range up to 36 RPM. Other drive arrangements and ranges of feeds and speeds are available.

For precision work, you need precision machinery. On your next mill requirement... investigate this new Betts or select the size you need from industry's widest range of mills... 100″ to 42′.

CONSOLIDATED MACHINE TOOL DIVISION
Farrel-Birmingham Company, Inc.
Rochester 10, New York
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Consolidated®

CM-32

E D Vancil (left), manager of the Meta-Dynamics Division of Cincinnati Milling Machine Co, has been elected vice president of the company. **L E Eberts,** assistant export manager, has been elected vice president of Cincinnati Milling's sales subsidiary, Cincinnati Milling & Grinding Machines, Inc

Thomas J Ault, former president of Long Manufacturing Division of Borg-Warner Corp, has been elected president of Saco-Lowell Shops, manufacturer of textile machinery and automotive parts

NAMES IN THE NEWS...

William A McGregor, manufacturing manager of the Industrial Products Division of Brown & Sharpe Mfg Co, Providence, RI, has been assigned new duties as general manager of Brown & Sharpe, Ltd, Plymouth, England, commencing Sept 1. **Earl P Leeds,** who has been general manager of the English plant for several years, is returning to Providence as director, federal government sales. **Thomas C Roberts,** director of manufacturing engineering, has been named Mr McGregor's successor. **Lester J Corser** succeeds Mr Roberts. He has been serving as assistant to the group superintendent of the Milling and Grinding Group of the Machine Tool Division.

L E Rasmussen has been promoted from plant manager to general manager of the Cincinnati division of Bendix Aviation Corp.

Ray M Ronald, manager of Hyster Co's tractor equipment division in Peoria, Ill, has been made a vice president in charge of the division. **Frank A Rostedt,** who has been managing director of Hyster's plant in The Netherlands, has been appointed vice president in charge of all Hyster activities outside the US.

Oscar L Dunn, general manager of GE's direct current motor and generator department in Erie, Penna, has been made general manager of the Motor and Generator Division in Schenectady. He succeeds **James M Crawford** who is retiring as vice president and general manager of the Division after 36 years of service with the company.

Garland W Reese has been elected a vice president of American Can Co and assigned to the executive department. He was previously vice president, manufacturing, for the Canco division. **Robert B Thompson,** formerly general manager of manufacturing, succeeds Mr Reese. **Leonard A Britzke,** who takes over Mr Thompson's former duties, has been serving as president of Bradley Container Corp, American Can subsidiary.

Eugene Ransom has been appointed general manager of the Industrial Hose Division at Flexonics Corp, Maywood, Ill. Formerly on special assignment at the Memphis, Tenn, plant, he succeeds **E W Driedger** who has resigned.

DuRay E Stromback has been named general manager of Plymouth manufacturing and engineering, Burroughs Division of Burroughs Corp. Former manager of engineering at Plymouth, he succeeds **Robert A Niemi** who has resigned

Glenn C Wilhide, Jr, has been appointed general manager of Black & Decker Mfg Co, Ltd, Brockville, Ont, subsidiary of Black & Decker Manufacturing Co, Towson, Md. He succeeds **Drummond R Stuart** who has resigned. Mr Wilhide was formerly purchasing manager.

Robert A Niemi has been named executive vice president and general manager of Allied Products Corp. He was formerly general manager of the Plymouth Division of Burroughs Corp.

George E Clark, president of the Adams Express Co, New York, has been elected chairman of the executive committee of Joy Manufacturing Co, Pittsburgh. **Louis G Helmick,** vice president and general manager of the company's Industrial Division, has been elected executive vice president to succeed **A B Drastrup** who has resigned.

George W Fenimore has been appointed assistant vice president of the Ramo-Wooldridge Corp, Los Angeles. He is succeeded as plant manager of the company's operations in Denver, Colo, by **I A Binder,** vice president, manufacturing.

Dr Phillip W Lett has been named chief engineer of defense engineering at Chrysler Corp. **Walter C Beyer,** vehicle engineer in the medium tank program, succeeds Dr Lett as assistant chief engineer.

Wilson P Burns has been named manager of the Cleveland Works of National Malleable & Steel Castings Co. Formerly superintendent, Mr Burns replaces **Stewart Tame,** who is retiring.

EXCLUSIVE...

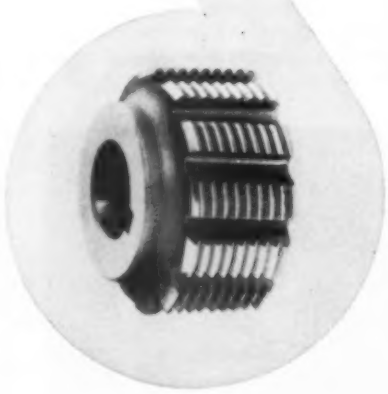
FOR BETTER THREADING

Highest quality threading at lowered costs are yours, with Hanson-Whitney's exclusive *"Finished after hardening"* Process. H-W's entire line of Multiple Thread Milling Cutters are manufactured by this unique process, providing you with these cost-cutting quality features:

- **Finest Thread Finish**
- **Closest Tolerances** — in tooth spacing, form and relief.
- **Minimum O.D. Runout**
- **Minimum Variation** — from parallelism and desired taper, permits quality threading to longest feasible length.
- **Uniform Tooth Clearance** — assures maximum cutter life.

Hanson-Whitney home and field specialists are always available to recommend practical solutions to *all* your threading problems. And you can count on nation wide Hanson-Whitney Stocking Distributors to provide fast, complete service.

Write for literature.



Hanson-Whitney
COMPANY
Division of Whitney Chain Company
206 BARTHOLOMEW AVE. • HARTFORD 2, CONN.

TAPS • THREAD GAGES • HOBS • CENTERING MACHINES • THREAD MILLING MACHINES AND CUTTERS

NAMES IN THE NEWS...

Thomas L Hammond, former vice president in charge of the General Products Division of Whiting Corp, Chicago, has been elected board chairman to succeed his brother, the late **Stevens H Hammond.**

Kenneth B Woods, head of the School of Civil Engineering of Purdue University, has been elected president of the American Society for Testing Materials. **A Allan Bates,** vice president of research and development, Portland Cement Association, has been named vice president.

Louis F Polk, vice president and group executive of Bendix Aviation Corp, and president of the Sheffield Corp, Dayton, Ohio, subsidiary, is congratulated by his daughter, **Mrs John Lillard.** Mr Polk received an honorary degree of doctor of science from Miami University at Oxford, Ohio, for "his contributions in advancing the arts of engineering, dimensional control, and metrology"

Elmer Pfeil has been elected president of the Machinery Dealers National Association. **Charles Kempler** is 1st vice president; **Alex Zeeve, Jr,** 2nd vice president; and **Richard Strom,** treasurer.

OBITUARIES

David E Cohn, vice president and treasurer of Chicago Gear Manufacturing Co, died June 13.

H Franklin Barrus, 70, joint managing director of E P Barrus Ltd, London, died June 4. Mr Barrus began his business career with the Union Twist Drill Co in Athol, Mass, where he was born, later joined his uncle, E P Barrus, in London representing leading American tool companies in Europe. Mr Barrus' sons are Franklin, export manager of Greenfield Tap & Die Co, Greenfield, Mass, and Lawrence, managing director of Cleveland Twist Drill (G B) Ltd.

Whether you figure your parts production in thousands or millions, a Wean "Flying Press" can help cut costs

There is really no minimum production figure at which the ability of the Wean "Flying Press" to reduce cost/piece is diminished. For example, a "Flying Press" sold to a contract stamper is enabling this firm to get more short-run business, since a very competitive price can be quoted.

But where component parts are produced in large quantities, substantial economies are assured with the Wean "Flying Press." Due to the unique design of the "Flying Press," it processes coil at up to 300 fpm *continuously:* the strip never stops for indexing but flows through the "Flying Press" at a uniform rate. This elimination of "stop-and-go" operation, which has characterized and limited conventional stamping presses for years, has a further advantage than speed of production alone: it's easier on the dies. Actual comparative tests conducted by a "Flying Press" user showed that monthly die maintenance was reduced some 36% when standard dies were run on the "Flying Press."

The complete concept of the "Flying Press" takes a good bit of explanation: the practicality of it for your operations also requires the personal service of a Wean Sales Engineer. We suggest that, as a first step, you write us for an illustrated brochure on the "Flying Press": then we can arrange to have a Wean representative call at your convenience to explore the matter further. If you are actively interested in how this unusual piece of processing equipment can serve you, we can run your dies on a demonstration machine at our Cleveland plant.

WEAN

WEAN EQUIPMENT CORPORATION

CLEVELAND 17, OHIO

Detroit • Chicago • Newark

STEEL *from Wheelock, Lovejoy*
BULLETIN

W-L CHICAGO Now in an ideal position to supply HY-TEN "M" Temper in large forged flats up to 6 x 22", rounds to 18" and squares to 17½". Also "B" No. 3-X in large forged flats to 6 x 13", rounds to 18" and squares to 16". Alloy forgings a specialty.

W-L DETROIT The new, larger warehouse and office here have greatly speeded up delivery on our orders and services in this area. Have a good stock of A-8620 on hand as well as all HY-TEN grades.

W-L CLEVELAND The rolls for this Vaughn Four-Roll Continuous Pointer are fabricated from HY-TEN "M" Temper, nickel-chromium-molybdenum oil hardening steel. This Pointer, largest of its type in the world, can point rods ranging from ½" to 1¼" dia. HY-TEN "M" was selected by the machine manufacturer because it can be quenched and tempered to high hardness levels while retaining considerably greater toughness than would be possible with most other steels.

W-L CINCINNATI Another new and larger warehouse recently opened here. Same-day service on all sizes, shapes and grades of HY-TEN, plus our usual help on metallurgical problems.

W-L HILLSIDE, N. J. This W-L warehouse has an excellent stock of HY-TEN "B" No. 3-X in rounds, flats and squares. Same-day delivery is promised. Many of the larger sizes of forged rounds are rough turned.

W-L CAMBRIDGE HY-TEN "B" No. 2 is still a great favorite in New England for parts requiring medium duty and high quality at a reasonable price. Our research and development assure better HY-TEN specials — "the standard alloy steels of tomorrow."

W-L BUFFALO New HY-TEN "B" No. 3X-40 now available here in rounds ½" to 8¼" and hexagons 1¼" to 2¾", heat treated to 300 Brinell. Machines as easily as heat-treated 4140 leaded, but less expensive. Suitable for flame or induction hardening — tough and shock resistant.

Write our Cambridge office today for your *free* Wheelock, Lovejoy Data Sheets. They'll give you complete technical information on grades, applications, physical properties, tests, heat treating, etc.

WHEELOCK, LOVEJOY & COMPANY, INC.
137 Sidney Street, Cambridge 39, Mass.
AMERICAN STEEL WAREHOUSE ASS'N

AGENTS: Southern Engineering Company, Charlotte, N. C.; Sanderson-Newbould, Ltd., Montreal & Toronto

NEW FILMS . . .

THE 1000TH BLISS TRANSFER FEED PRESS. *Produced by E W Bliss Co, 1375 Raff Road, S W, Canton 10, Ohio. 16 mm, sound, color. Running time 15 min. No charge.*

This interesting film shows in complete detail how a 250-ton press produces a finished automobile starter brush and plate by automatically passing a blank through an 11-station series of dies. The press performs 11 different operations, including drawing, piercing, lancing, forming, and ironing. The transfer feed mechanism is thoroughly documented, as are the automatic safety guards which protect against misfeeds.

•

THE NECESSARY NUISANCE. *Produced by Master Chemical Corp, 13 Huron St, Toledo, Ohio. 16 mm, sound, color. Running time 36 min.*

Explaining the role of modern coolants in cutting and grinding procedures, this film answers many of the questions encountered in machining. Information is given on the effect of various concentrations of different types of coolant on cutting tools and grinding wheels.

•

AUTOMATION COMES TO DIECASTING. *Produced by DCMT Sales Corp, Dept K45, 80 Shore Rd, Port Washington, NY. 16 mm, sound. Running time 18 min.*

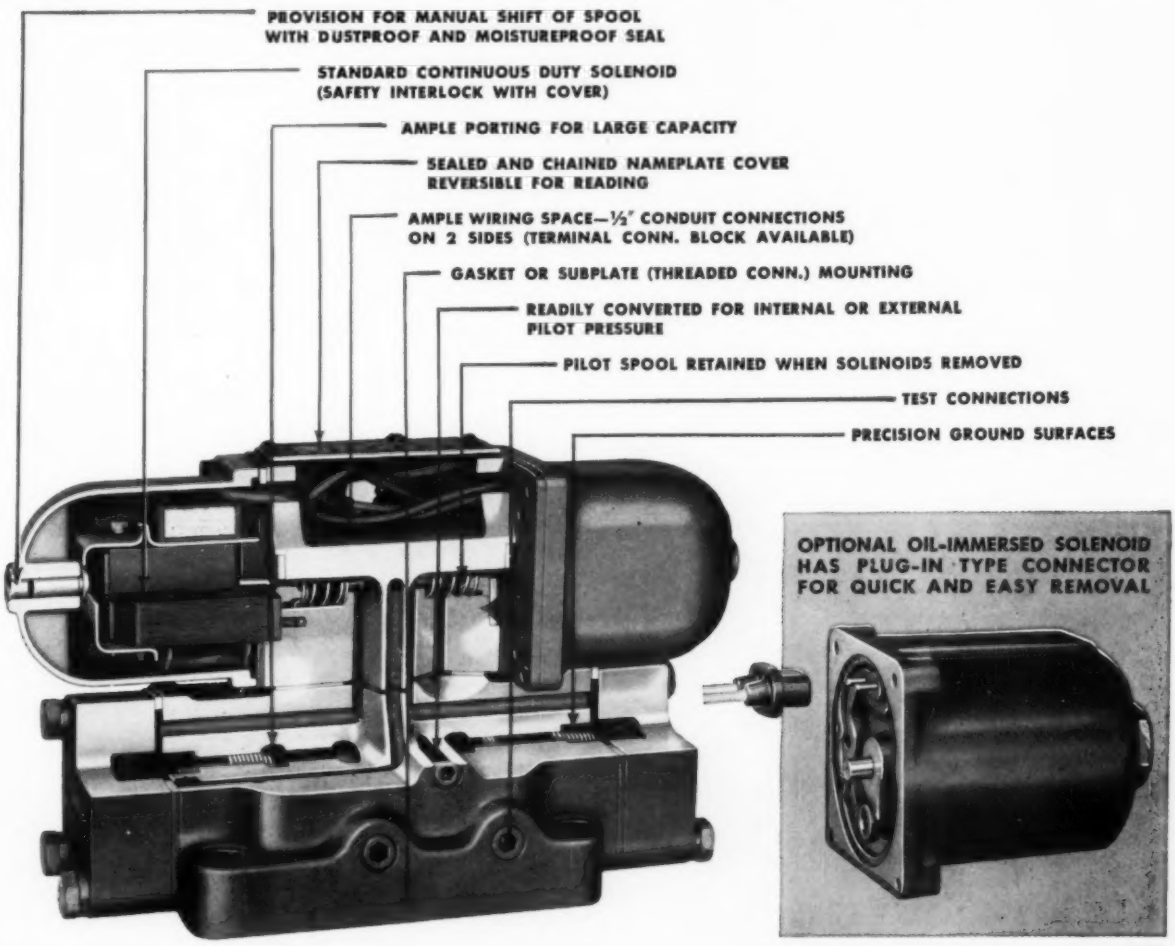
Designed to explain the manufacturer's completely automatic diecasting machine for small and medium parts, this film explains the operations and shows a bank of machines in operation. Called the RAM Automatic, the machine is shown in operation without operator attention, producing zinc castings up to 1 lb in weight at rates as high as 1500 shots per hr.

•

SHELL MOLDING TECHNIQUES. *Produced by Monsanto Chemical Co, Dept SM, Springfield, Mass. 35 mm slide film, sound, color. Running time 20 min. No charge.*

Illustrated entirely with artwork, this film shows the step-by-step techniques of shell molding. It describes both dump-box mixing and sand coating, as well as the production of dumped and blown shells and cores.

Only VICKERS® DIRECTIONAL VALVES Have *All* These Features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READILY CONVERTED FOR INTERNAL OR EXTERNAL PILOT PRESSURE
PILOT SPOOL RETAINED WHEN SOLENOIDS REMOVED
TEST CONNECTIONS
PRECISION GROUND SURFACES
OPTIONAL OIL-IMMERSED SOLENOID HAS PLUG-IN TYPE CONNECTOR FOR QUICK AND EASY REMOVAL
7897

REDUCED DOWN-TIME
LONGER SOLENOID LIFE
LESS MAINTENANCE
EASIER INSTALLATION

Vickers hydraulic 2- and 4-way valves provide the optimum in directional control. They are compact, versatile, and are designed for heavy duty, continuous and rapid cycling operation on all types of industrial machinery. More than a decade of application experience and years of research and development back all the valves' features.

Seven spool types satisfy a wide variety of circuit needs and operate at pressures to 3000 psi. Optional oil-immersed solenoids operate cooler, increasing service life 20 to 30 times.

Installation is simplified with ease of wiring and a minimum of piping. The valves are available for gasket or sub-plate mounting. Mounting position is unrestricted except in "no-spring" models. The optional oil-immersed solenoid has a plug-in type connector and is available in all standard voltages. Field modification of existing units can be made to incorporate heavy-duty, oil-immersed solenoids.

The valves conform to JIC Standards and are available in ⅛" and ¼" direct solenoid operated models . . . ¾", 1¼", 2", and 3" solenoid controlled pilot operated models. These valves cover the flow range from 1.25 gpm to 320 gpm.

For further information, write for Installation Drawing I-182412.

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problem: prevent dust from damaging costly precision machines.

answer: trap dust at its source with *unitized* Torit Dust Collectors.

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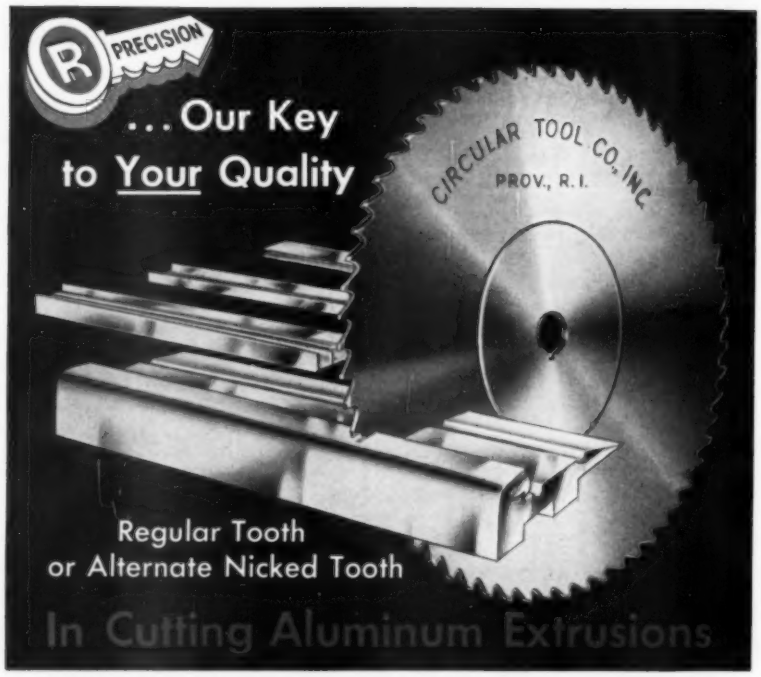

CIRCLE R precision underwrites *your* precision by holding within correct tolerances for the operation required. Specially designed for cutting aluminum extrusions, this saw proves highly efficient. Ask Circle R representatives about its performance, and use our know-how in cutting this important metal.

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CIRCULAR TOOL CO., INC.
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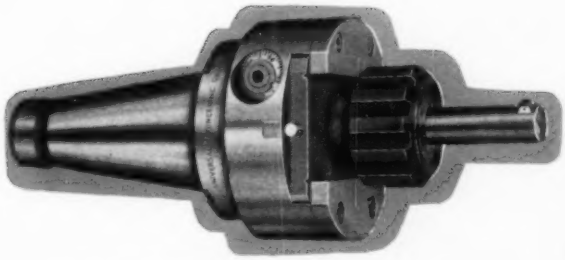
Specialists in Circular Cutting Tools Since 1923

From the *American Machinist* Library of Tips for Top Shop Men

THE old Army slogan, "If it moves, salute it; if it doesn't, pick it up; if you can't pick it up, paint it," can well be adapted for plant use by changing "salute" to "guard" and "paint" to "oil."



UNIVERSAL BORING CHUCK is heavy and rigid for all types of rough boring without chatter yet accuracy of adjustment adapts it equally well to finish boring. Time-tested Universal Collet nose holds boring tool much more rigidly and securely than set screws while precision and extreme accuracy of feed-adjustment are obtained by an anti-backlash arrangement of feed screw and large dial.

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COLLET CHUCKS

combine maximum holding power and minimum run out with simplicity of design and low price

The basic collet principle is the same in all Universal chucks. Tools gripped in these chucks withstand a maximum thrust and radial load because the collet grips on a continuous surface its full length and positively locks the tool. Write today for new catalog showing the complete line of Universal collets and chucks.

UNIVERSAL RELEASING TAP CHUCK has same basic collet principle featured in all Universal Collet Chucks. Screws or sleeves are not needed and collets are interchangeable with other Universal chucks. Simple, compact design has no springs, cams or pawls to break or wear. Can be used for either right or left hand tapping without adjustment.

HIGH PRESSURE REVOLVING COOLANT TRANSFER CHUCK has standard Universal Collet Chuck nose and a variety of shank sizes can be held by simply changing collets. Minimum overhang is made possible by the single face seal design. Back pressure principle of this design prevents "brake" action thus lowering torque on spindles. Chucks for higher speed and pressures than standard plus a variety of mountings are also available.

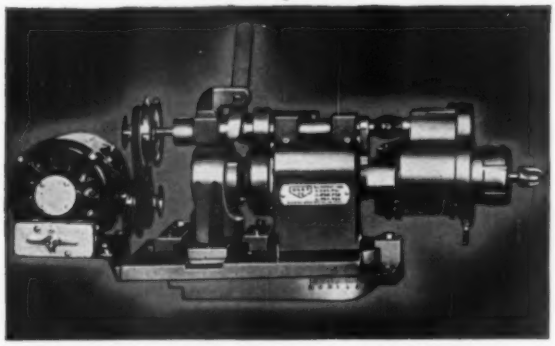
210

UNIVERSAL FLOATING COLLET CHUCK for horizontal or vertical operation is positively protected against destructive action of coolant by a seal which prevents entrance of compounds into interior of assembly. Frictionless ball bearing flat springs are adjustable to counter-balance weight of the tool.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 1, MICHIGAN

Precision CIRCULARITY GRINDING ATTACHMENT

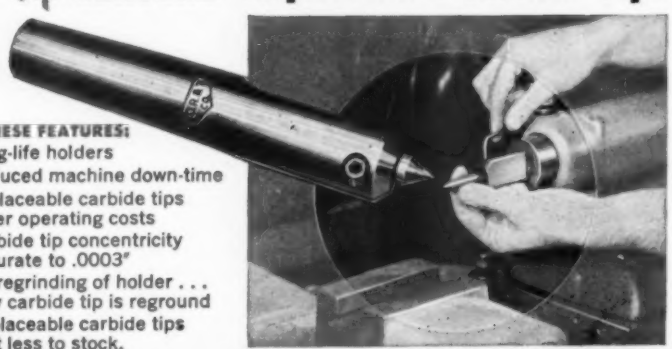


Simple, speedy set-ups on this accurate attachment permit fast and easy grinding of form relief, a combination of form and radial relief, tapered cylindrical and straight cylindrical.

Model 500 Circularity Grinding Attachment is faster—easier to handle—has positive control—greater adaptability—rugged construction—is engineered and built to provide the finest precision work.

You Can Grind Tools Like These On A DETROIT REAMER CIRCULARITY GRINDING ATTACHMENT

Grip-Tip CENTERS–Replaceable Carbide Tips



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1. Long-life holders
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4. Carbide tip concentricity accurate to .0003"
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What's Ahead? . . . see Page 2

Yes, American Machinist's "Chips" column on page 2 of each issue forecasts coming events in future issues, and also points up behind-the-scenes stories of how current articles are gathered and written. Form the "Chips" habit—read it every issue.

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The NEW AMERICAN MACHINIST'S HANDBOOK

Edited by
RUPERT LE GRAND

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Here's the biggest news in years for machinists, toolmakers, apprentices, designers, engineers, inspectors—in fact *all* in the metal working industry. Now you can have the on-the-job help of an *amazingly improved, fully-up-to-date*, NEW AMERICAN MACHINIST'S HANDBOOK.

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The facts behind this monumental change

Think of the advances of recent years in metalworking in all its aspects—not only the normal development of better tools and techniques in an important industry, but also the further advances demanded by work on new materials and new design applications! *The growth in metalworking technology, standards, and practice has been tremendous* — faces every man in the field with a great need for new working information. To meet this urgent need, the NEW AMERICAN MACHINIST'S HANDBOOK has been created — fully abreast of today's practice—and given to you with the practical treatment and handy reference features that will make this the "bible" of the industry for many years.

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The NEW AMERICAN MACHINIST'S HANDBOOK is so concisely written, so logically arranged, so packed with facts, that you'll find it of almost daily use in your work. Look up in it questions, large and small, on layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances, forming and finishing methods—hundreds of details of machine shop and drawing room practice. You'll find the authoritative answers that will mean time and money saved and better results in all your work. See for yourself—have the book at your elbow—consult it for 10 days at our risk. No obligation to keep it unless it meets your needs. Just mail the coupon below.

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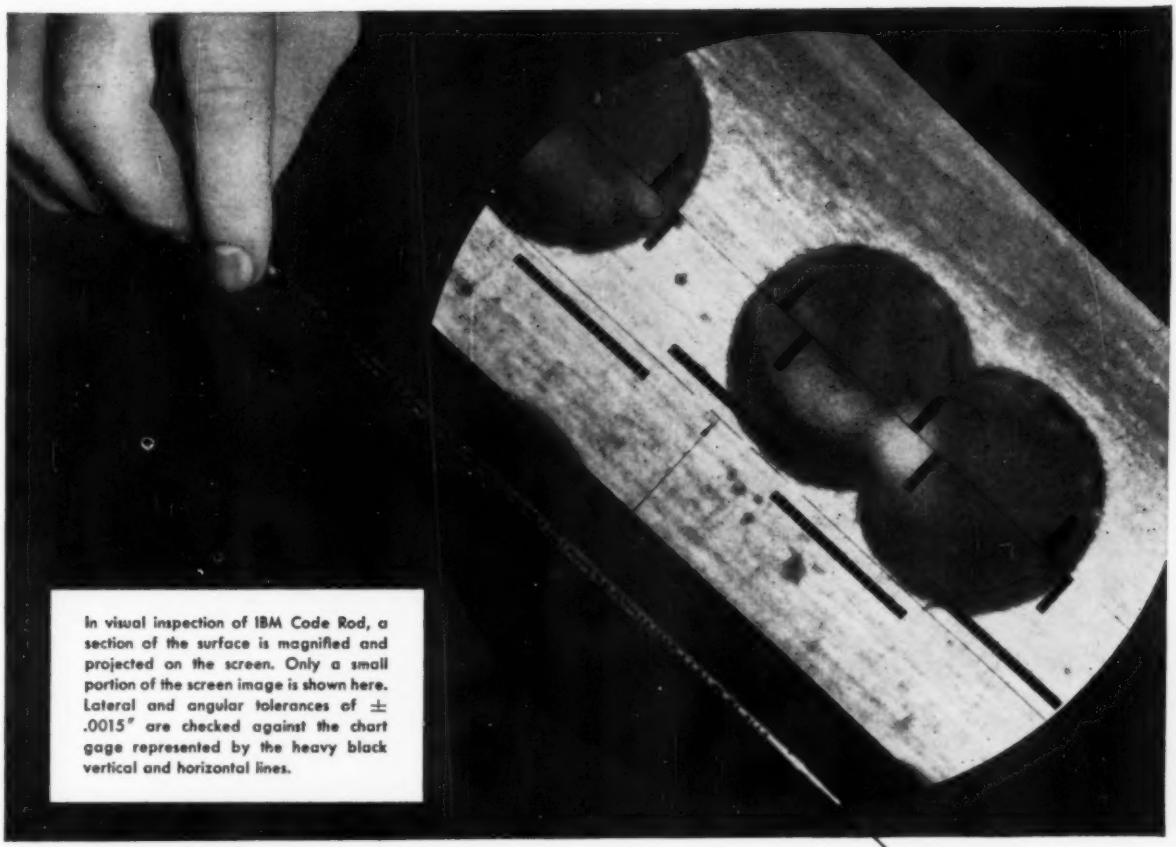


In visual inspection of IBM Code Rod, a section of the surface is magnified and projected on the screen. Only a small portion of the screen image is shown here. Lateral and angular tolerances of ± .0015″ are checked against the chart gage represented by the heavy black vertical and horizontal lines.

How would you gage these 1,118 holes?

Here's how IBM did it... and smashed an inspection bottleneck

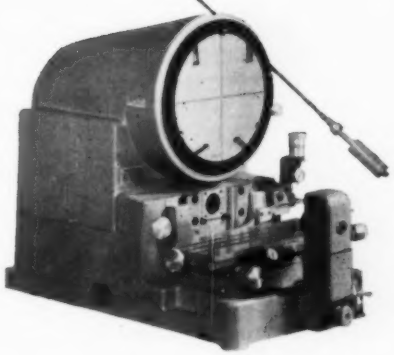
Here's how International Business Machines Corporation boosted the inspection rate on its new Code Rod from 1 or 2 *per day* to 15-20 *per shift*—keeping pace with production, yet maintaining complete accuracy—with a Kodak Contour Projector, Model 14-2A.

The Code Rod is used with the new 720 High Speed Wire Printer, developed by IBM to overcome the speed limitations of conventional bar type printers. The rod is a stainless steel tube with no less than 1,118 $\frac{1}{32}$″ holes. The holes are drilled in various combinations at 7 different intervals in 7 straight rows down the 8″ length of the tube. Obviously the inspection problem is of no small proportions.

Lateral and angular tolerances for the holes are ± .0015″. *To maintain these tolerances is critical because any mis-drilled holes would cause an error in the shape of the characters to be printed.* What's more, the 720 Printer operates at extremely high speeds, and any slight error could affect its operation.

In visual inspection a master Code Rod is placed next to the rod to be inspected. Both surface images are projected on the screen. The operator simply indexes the image along simultaneously, so that he always has a correct rod in view for comparison of the hole grouping. He checks tolerances by a chart gage on the projector screen.

Got an inspection bottleneck at your plant? Optical gaging with a Kodak Contour Projector may well be the answer. The booklet "Kodak Contour Projectors" gives examples of how other firms are profitably using Kodak Contour Projectors, plus full data on the various models we offer. The booklet is available on request from:



Kodak Contour Projector, Model 14-2A, is a versatile precision measuring instrument for production lines or toolroom. It is one of 6 Kodak Contour Projector models available to meet all your optical gaging needs. Operators work in complete comfort, need little training.

Apparatus and Optical Division

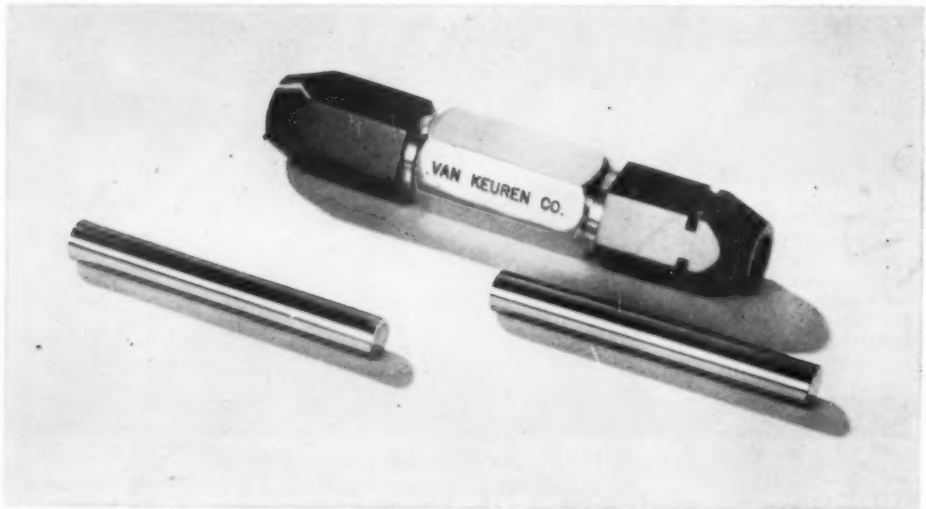
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

IMMEDIATE DELIVERY

Van Keuren Wire Type Plug Gages



WIRE TYPE (REVERSIBLE) PLUG GAGES were originated by **THE VAN KEUREN CO.** in 1923, and since that time have been supplied to an ever expanding group of manufacturing concerns throughout the country and abroad. The wire type design has enjoyed tremendous popularity because of the inherent economy represented by the fact that the gage units can be reversed, or cut off, to obtain substantial increase in gage life.

As a result of our long experience in developing and pioneering the manufacture of wire type plug gages and the sale of millions of these units, we have come to know what sizes will be required during a given period of time, and have prepared ourselves by finishing in advance a multitude of units which are in constant readiness for shipment. Our methods of size prediction through research and sales analysis have been successful to the point that there is now better than a four out of five chance that at any time we will have on hand the gage or gages that you need. In addition improved and highly efficient methods of manufacture developed during the years of our work in this field make possible the manufacture, to your requirement, of any size not on hand, in an incredibly short time.

VAN KEUREN WIRE TYPE PLUG GAGES are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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39th YEAR

THE Van Keuren CO.,

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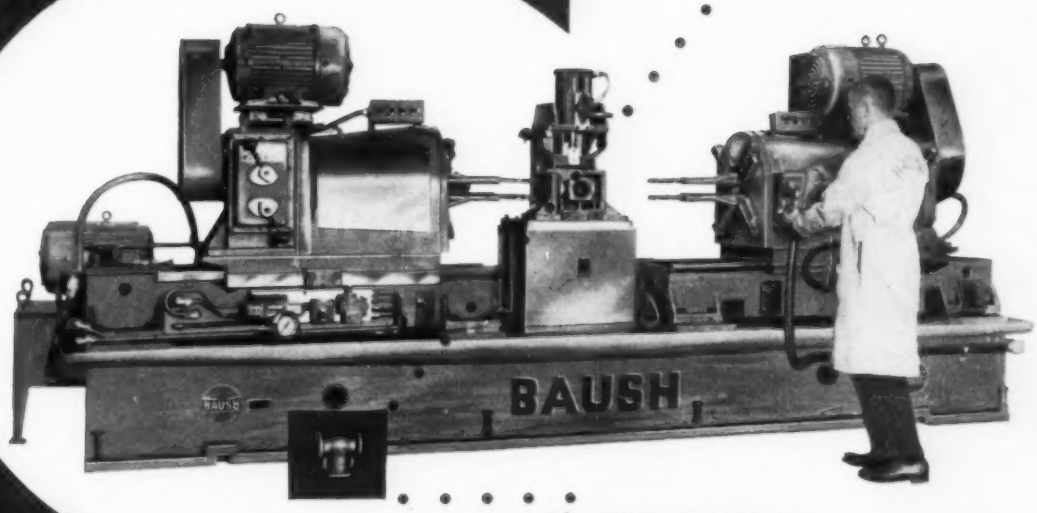
Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

2-WAY HORIZONTAL DRILL HANDLES BOLT CIRCLE HOLES FROM 7/16" to 7/8" DIAM. in STAINLESS STEEL.

This Baush Multi-Spindle Drill is another example of BAUSH design and adaptability to almost any problem.

This horizontal unit drills holes ranging from 7/16" to 7/8" in diameter in the bolt circle of Stainless Steel Gate Valve bodies.



Stainless Steel Gate Valve with double bolt circles.

SPECIFICATIONS:

Machine has welded steel base with coolant tank and chip trough — hydraulic slides with 18" stroke — and hydraulic tank, pump and valves to actuate the 5 slides.

Ways are hardened and ground. Two (2) 14" dia. Round Heads have 4 spindles each with adjustable arms. Heads have four (4) speed shifts and hand lever gear box, as well as special support plate to support spindles and arms for individual manual adjustment "in and out" on a straight line for four (4) unequally spaced bolt circle holes.

Holding fixture and bushings guide drills and all electrical controls are J.I.C. Standard, arranged for jogging.

Whether it is a 36 station transfer, an 8 station rotary, or a unit such as this one illustrated — YOU CAN DEPEND ON BAUSH TO DESIGN AND BUILD THE BEST.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Finish obtained in machining REX M-2-S eliminates the need for finish grinding this 4" x 4" unground double thread cutting hob.

Hobs seldom need finish grinding when made of low cost REX M-2-S

This is the actual finish obtained – without costly finish grinding – with REX M-2-S,® Crucible's *sulfur-bearing*, tungsten-molybdenum type high speed steel. The chemistry of this resulfurized steel readily provides the machinability needed for the final, critical "backing-off" operation in making hobs. It doesn't tend to tear or produce rough finishes – as nonsulfur-bearing steels of this type so often do.

REX M-2-S costs about 30% less than T-1 types, too, because it's lower priced per pound, and provides 5.4% more linear feet per pound.

Crucible REX M-2-S is also equal in red hardness to the T-1 types, and even more resistant to abrasion. It's also tougher than any other tungsten type high speed steels, and hardenable over a wider range than any other molybdenum high speed steels.

Qualities like these make REX-M-2-S extremely suitable (and economical) for broaches, chasers, lathe tools, reamers, taps and hobs as well as other tools normally requiring high speed steel.

For further information, just ask for details on REX M-2-S – or all the Crucible high speed steels today. Write: *Crucible Steel Company of America, Dept. TG01, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

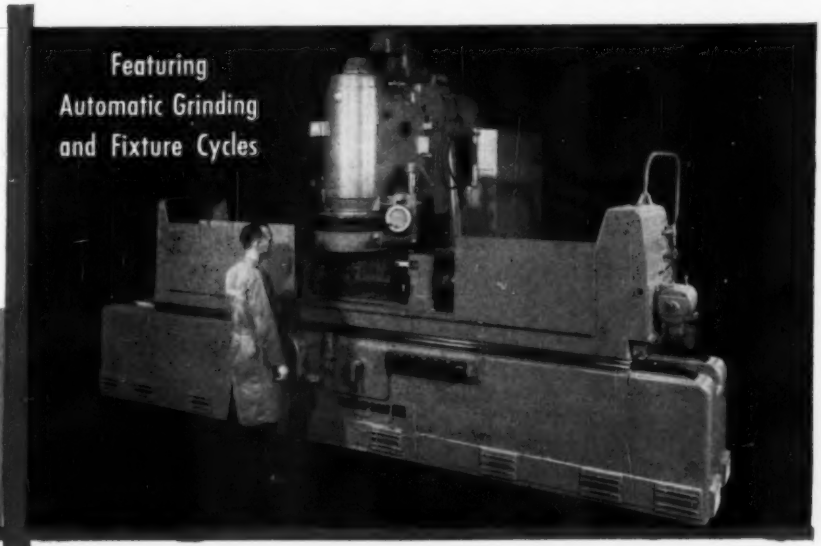
CRUCIBLE STEEL COMPANY OF AMERICA

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

THOMPSON handles the toughest production jobs... *fast and accurately...*

with

THE VERTICAL SPINDLE SURFACE GRINDER



SPECIFICATIONS

Size: 18" x 18" x 62"
Wheel: 22" Segmental
Production: 30 blocks per hour
Total Stock Removal: .010"

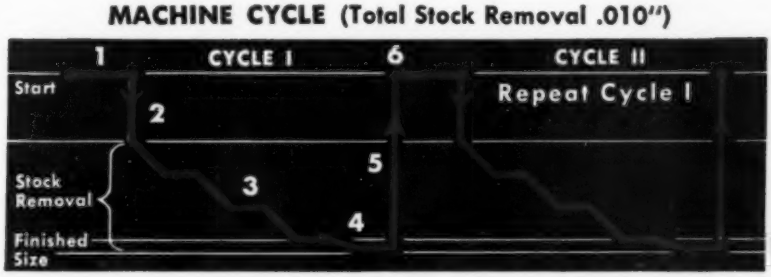
Shown above is the latest Thompson vertical spindle machine grinding the diesel engine cylinder blocks of a leading truck manufacturer. To meet the demand for fast, continuous production, both the fixture and grinding cycles are automatic and are interlocked to prevent accident. A separate hydraulic power source operates the single place fixture which locates the cylinder block on the main bearing holes.

Since any variations in stock removal would affect the compression ratio of the engines, constant accuracy is controlled throughout the grinding cycle. The operator merely sets wheel contact with the work and automatic operation begins.

Thompson vertical spindle surface grinders are made in various types and sizes to meet all job requirements. All machines of 40 inches and up in work length are equipped with the Hydra-Cool Hydraulic System*—the exclusive Thompson feature that eliminates all heat distortion throughout the machine.

*Pat. Applied For

MACHINE CYCLE (Total Stock Removal .010")



CYCLE I

- Load work piece into fixture and start table cycle.
- * Manually lower grinding wheel to contact work piece.
- Automatic downfeed of wheel occurs at each table reverse to remove .010" stock.
- Spark out to final size with table moving to start position.
- * Manually elevate grinding wheel to starting position and release work piece in fixture.
- Table automatically stops.

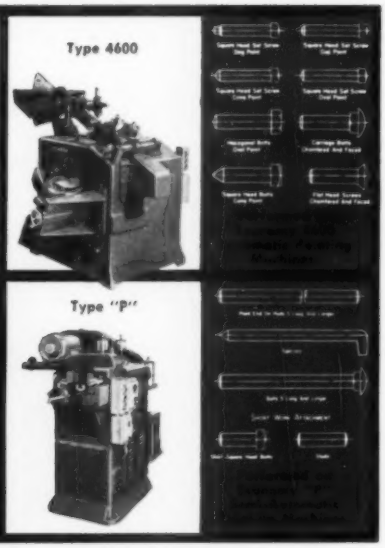
**Can be furnished as automatic functions.*

Thompson SURFACE GRINDERS

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

one operator runs several machines



Automatically **Point Bolts and Cap Screws on ECONOMY** *hopper fed pointing machines*

For more than 42 years, the Economy line of second operation machines has met with ever increasing acceptance by manufacturers in many fields of endeavor.

Increased production rates with reduced machining costs have transpired with the development of new machines.

The Automatic Pointers are available in two sizes — Type 3300 for uniformly pointing bolts and screws to ⅜" diameter and ¾" to 3½" in length, the Type 4600 for pointing bolts and cap screws, ¼" to ¾" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

Production rates of the Type 3300 vary infinitely from 2000 to 6000 finished parts per hour and on the Type 4600 from 1800 to 5400 per hour.

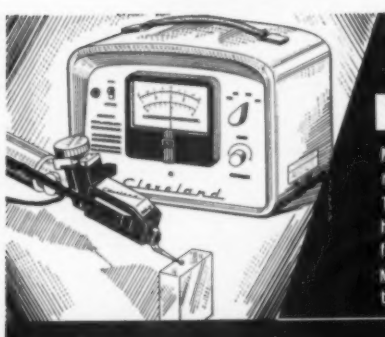
Also available is the Type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods ¼" to 1½" diameter, 5" or more in length. Production rates up to 2000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing & Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Double End Automatic Pointing Machines

THE ECONOMY ENGINEERING CO.
WILLOUGHBY, OHIO
WILLOUGHBY-OHIO
Designers and Manufacturers of Secondary Operation Machines since 1915



The MOST ACCURATE MOST RUGGED— HEIGHT GAGE

Measures in thousandths, ten-thousandths or millionths of an inch.

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More INDI-ACs are sold than any other electronic height gage.

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The supply is limited, but there is still time for you to order complete copies of this remarkable report. If you saw the *How to Work Steel* section in your 1955 Production PLANBOOK issue of *American Machinist* . . . you know every production executive and engineer in your shop can make profitable use of the information it covers.

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Breakage due to clogging is prevented because this improved cutting tool provides more than ample chip room. Furnished singly in sizes desired or in convenient wood block sets as illustrated.

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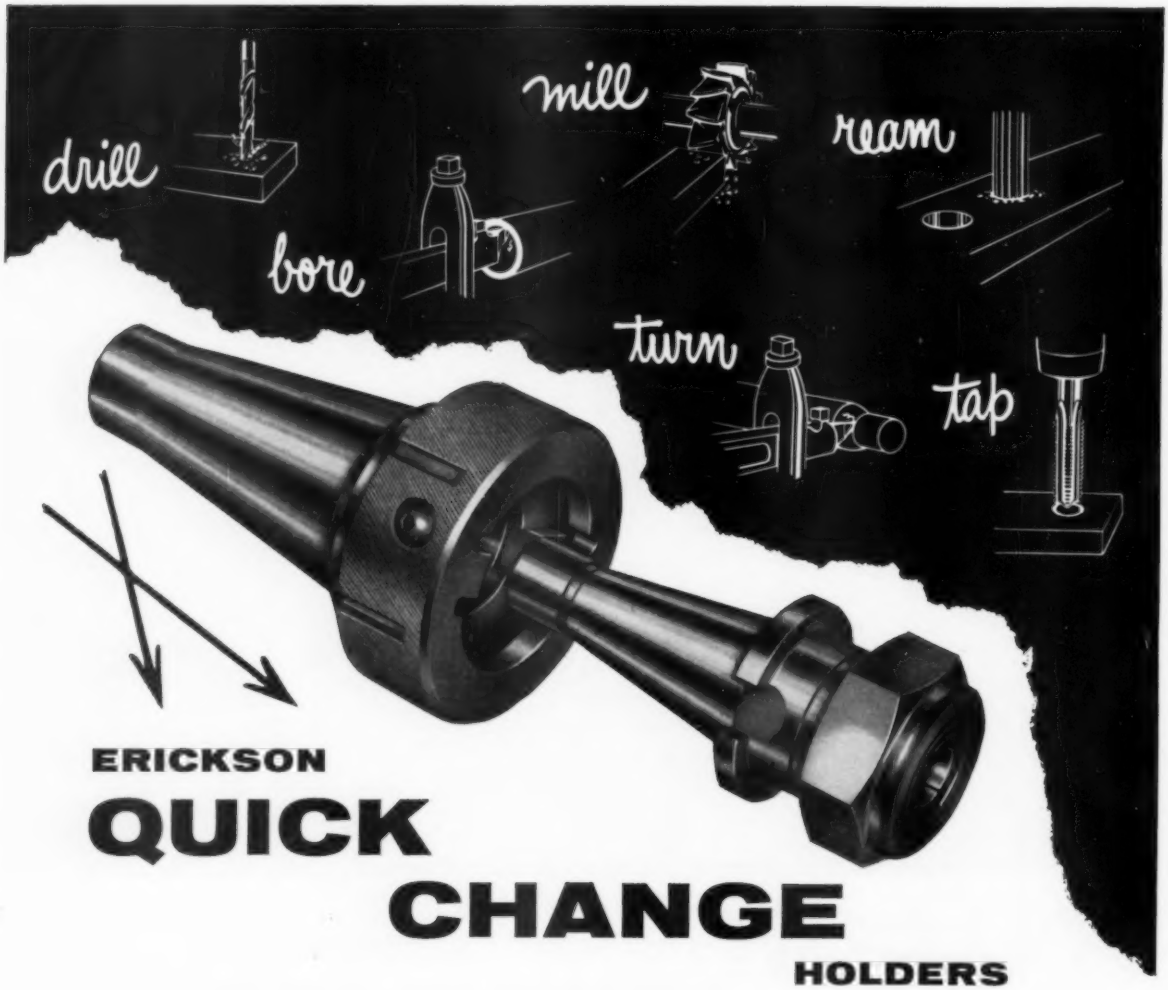

ERICKSON

QUICK CHANGE

HOLDERS

...for use with your standard MMS tapered tools
...designed for presetting of tools

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30 or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

AA-T455

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."

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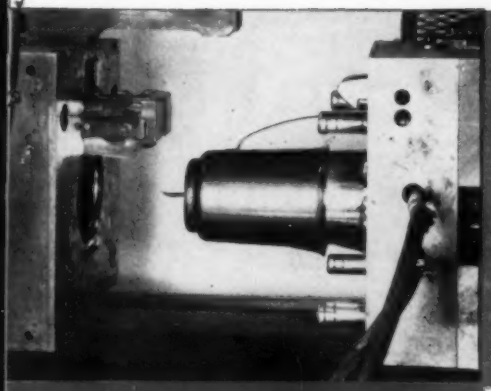
COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

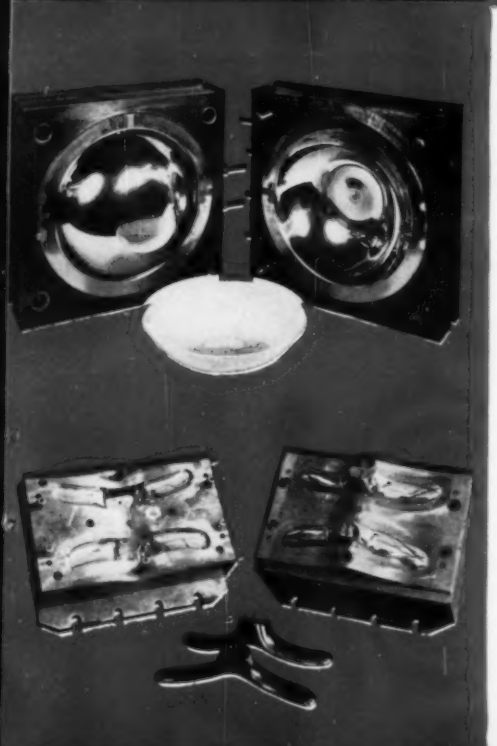
names that mean

"*First Quality Guaranteed*"



DIE STEELS

for
plastic molds
and die casting dies



MC The Mold and Cavity die steel made with particular care to permit blemish-free, highly finished surfaces. Furnished heat treated to 300 Brinell or annealed. Very deep hardening—uniform throughout large sections. Very low movement when oil quenched. For lower finishing costs and longer die life, use MC!

Speed-Cut Free-machining at 300 Brinell. Choose Speed-Cut for economy in producing backing plates, cavity plates, spacer blocks and other plastic die parts. And when you must avoid *all* movement, machine Speed-Cut after hardening—with ease!

Hotform The original 5% chromium, most widely-used die casting die steel. Will withstand extremes of service conditions—tough, strong, highly resistant to thermal shock.

Write for detailed Data Sheets

Vanadium-Alloys Steel Company

LATROBE, PENNSYLVANIA

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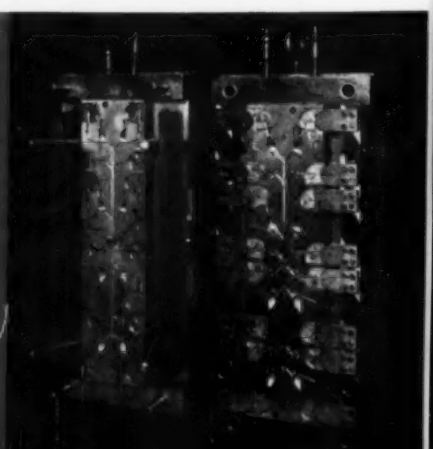

Man's Eternal Struggle with the Machine

AS PROFITS SHRINK AND COSTS CONTINUE TO GO UP, MORE THAN JUST "THE VENDOR'S QUOTATION" IS NEEDED!

Certainly you have to depend on your vendors . . . but how much?

The answer is "completely"! Your job is tough enough without your having to be a machine design or materials handling expert, too.

When you're specifying equipment, you should *only* have to provide an objective explanation of the problem, as well as the understanding of the product and related processes.

The vendor is the expert who's supposed to analyze that problem, then design and supply the necessary equipment. And the equipment should be ready to do your job when it's installed, too. Your overhead can't afford the lost production time and expense while you test and prove the vendor's equipment for him. After all, your original specifications called for equipment *to do a particular job.*

Sciaky has always accepted the vendor's full responsibility for design, manufacture and *delivery into production* according to the original specifications. That's why Sciaky resistance welding and production equipment satisfies the requirements of *your* particular job. That's why Sciaky operates the only independent, fully staffed and equipped Research Center devoted to advancing the application of resistance welding processes.

Why take less than the full advantage of consulting with a Sciaky Application Engineer the next time you are considering equipment. No obligation, of course.

The manufacturers of automobile wheels took that advantage. As a result those wheels are now assembled with automatic resistance welding that includes four other operations—not only assembled better, but faster and at lower cost. Write for the details of this unusual high production application that satisfies the most rigid specifications for weld quality.

65A

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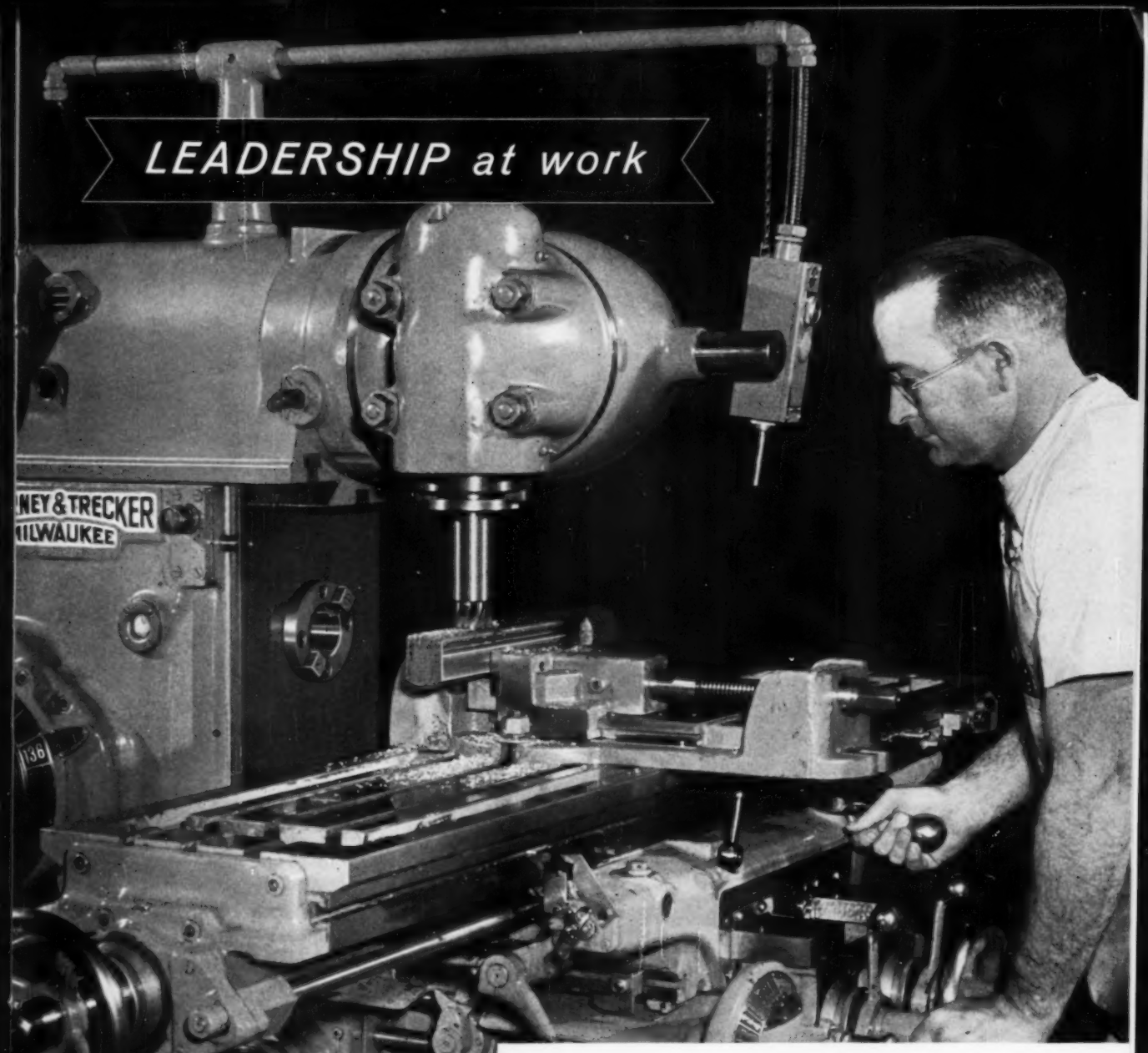


Milling versatility pays on atomic power project—Versatility is the reason why General Electric's Atomic Power Equipment Department, San Jose, Calif., selected this Kearney & Trecker—Milwaukee No. 3 Model CH Ram Head milling machine. Job pictured involves milling of soft steel clevis pins, with operator Patrick Finnell at the controls. Machine versatility results from combination of standard horizontal spindle with separate motor-driven vertical spindle mounted on sliding ram.

KEARNEY & TRECKER
MILWAUKEE

6786 W. NATIONAL AVE., MILWAUKEE 14, WIS.

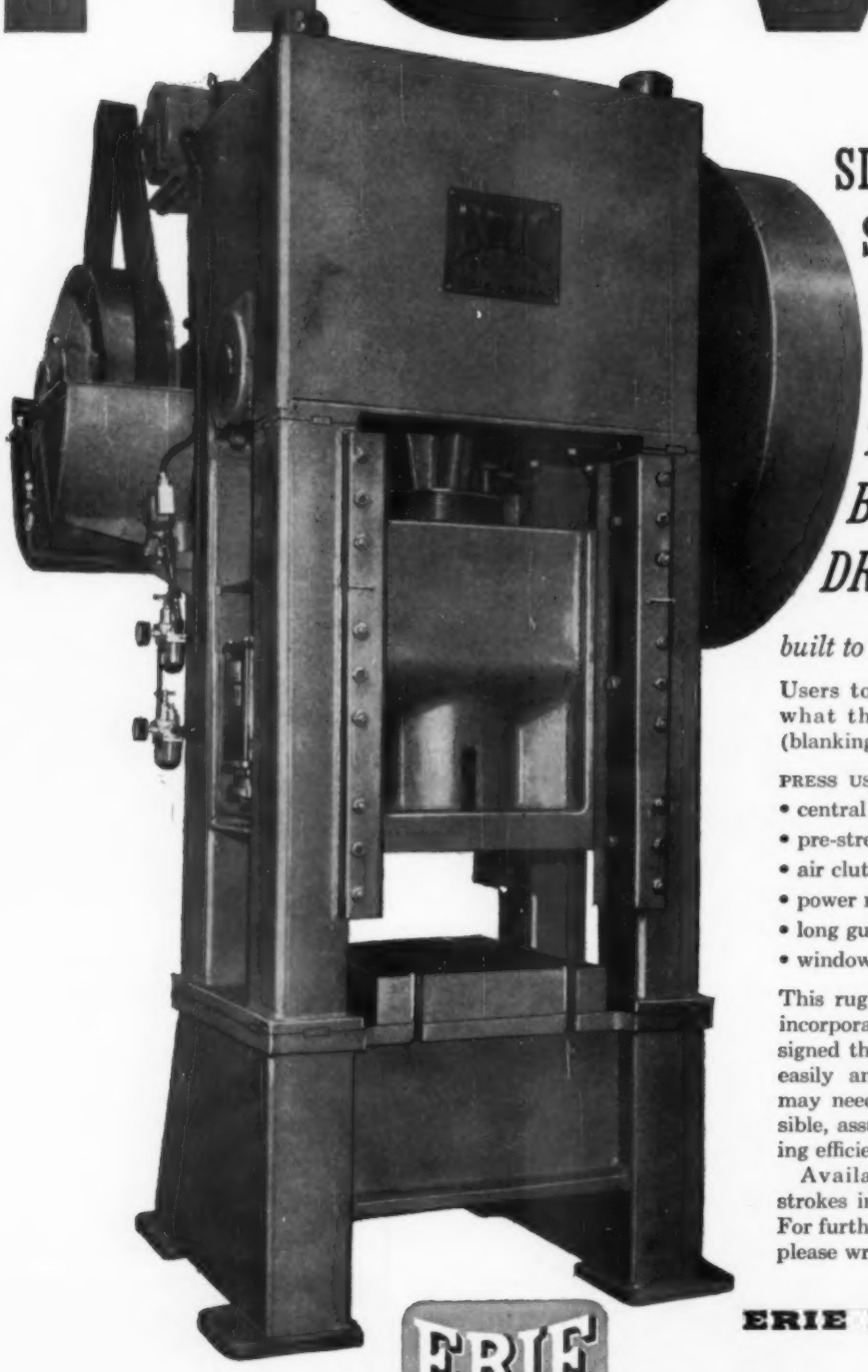
Kearney & Trecker staff photo by Ron Johnson

Kearney & Trecker's man on the job . . .

Frank Cavenagh, Moore Machinery Co., San Jose, helped General Electric select the machine shown here. *For expert milling counsel, call the K&T man near you. And remember to ask him, or write direct, for free comprehensive catalog.*

new

FROM ERIE FOUNDRY CO.



SINGLE POINT, STRAIGHT SIDE PRESS for *TRIMMING BLANKING DRAWING*

built to J. I. C. standards

Users told Erie Foundry engineers what they wanted in a trimming (blanking and drawing, too) press.

PRESS USERS ASKED FOR:

- central forced lubrication
- pre-stressed strain rods for rigidity
- air clutch and brake
- power ram adjustment
- long guide faces, easily adjusted
- windows in the side housing

This rugged new Erie Foundry press incorporates all these features so designed that maintenance may be done easily and quickly. All parts which may need servicing are readily accessible, assuring maximum press operating efficiency.

Available in various speeds and strokes in sizes from 150 to 600 tons. For further information, or quotations, please write.

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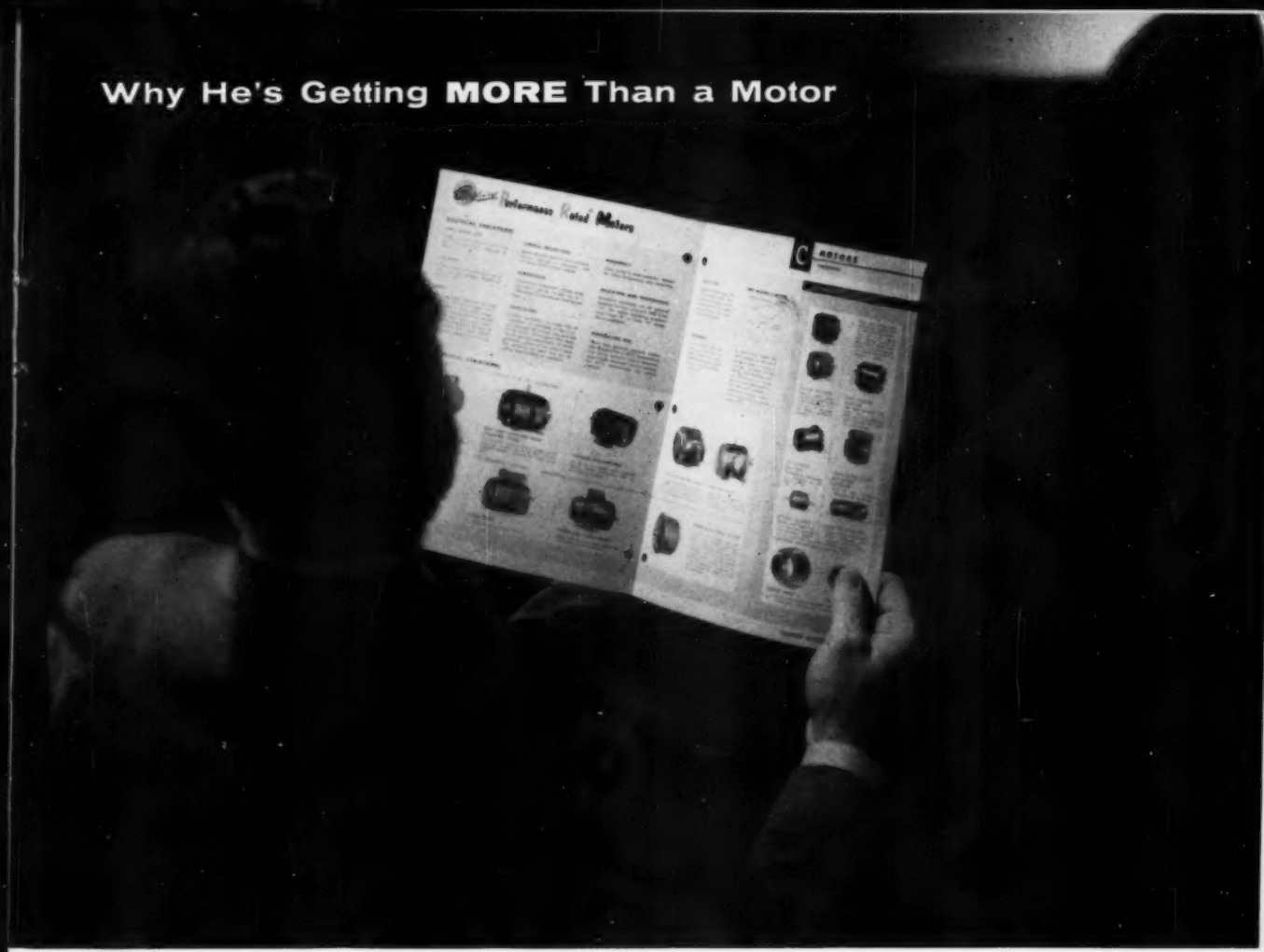
Why He's Getting **MORE** Than a Motor



He's getting answers to motor problems the easy way

with the Century Electric Motor Application Guide

Want a quick, easy way to get answers on motor applications? This easy to follow Century Electric motor application guide will help you do just that. Here's how you can make it work for you.

Suppose you need a motor to drive a fan. Knowing your power supply (a-c or d-c) you look on the chart on page 2 for the motor whose characteristics match the load you want to drive. Having done this it's easy to check the mechanical variations (page 8) to find the enclosure you need—depending on whether it is operating in an explosive, moist, etc. atmosphere. Then you have type, dimensions and operating characteristics, all at your fingertips.

Of course, this is good for simple routine applications. If your problem is more complicated, your Century Electric sales engineer will be glad to help. He can sit down with you and offer on-the-spot advice or if necessary get more complete data—drawing and models for you.

Such help explains why you get *more* than just a motor from Century Electric. Century Electric Company, 18th and Pine St., St. Louis 3, Missouri.

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St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

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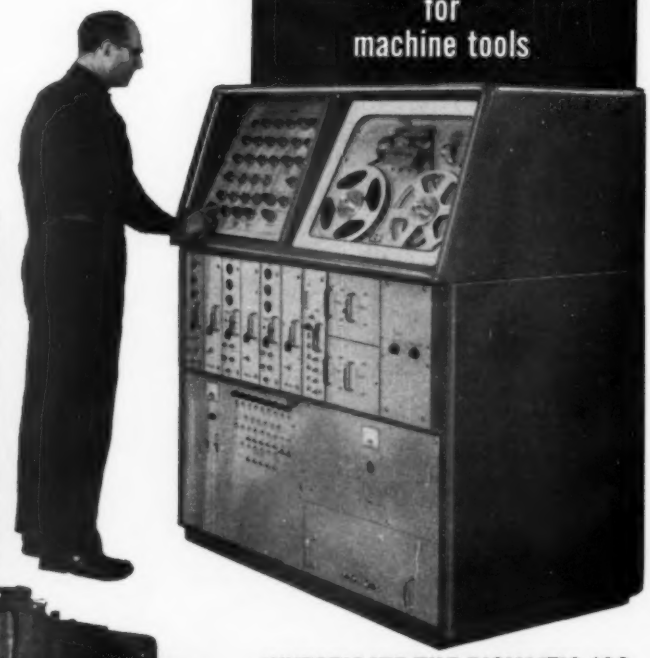
Reduce Costs Increase Efficiency

DIGIMATIC

contour control system for machine tools



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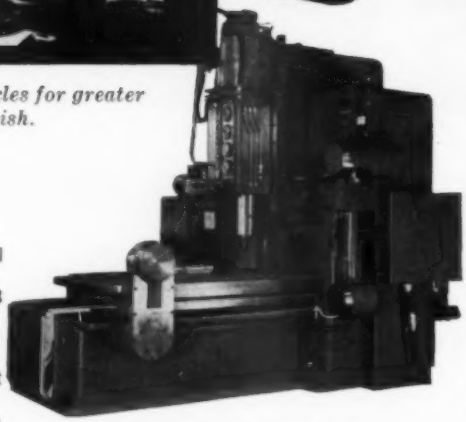

FAST...
- 3½ hours from blueprint to finished piece... for a typical part.
- Director prepares ½" tapes at 8 times cutting rate.

ACCURATE...
- Closed loop servo provides constant check on position.
- Automatic slow-down on inside cuts prevents over-shoots.

ECONOMICAL...
- Lowest cost control system, both in purchase price and in operating expense.
- Keyboard "Programming" by machine shop personnel.
- Eliminates cost, maintenance and storage of "hard" tooling.
- Shortens lead times and reduces first-part cost.

INVESTIGATE THE DIGIMATIC 180 MILLING MACHINE CONTROL!

It's the lowest priced, easiest to operate high-performance contour control system you can purchase today. Commercial deliveries are now being made.

Control illustrated is now in use at Convair-San Diego. This is the first of fifteen DIGIMATIC 180's combined with Morey A50 contour milling machines being delivered to Air Force contractors.

Provides three-axis coordinated control with 100-inches per minute (max.) cutting rate. (±0.001 inch tolerance.) Compact: 48" wide x 35½" deep x 61" high.

DIGIMATIC Controls are now available on a number of well-known machine tools in a variety of sizes.

Write for 16-page, illustrated Brochure giving complete details and specifications.

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Modernize! Replace the old, outdated features on your presses with brand new factory-engineered assemblies. New clutches, new slide adjustments, new bearings—these are only three of the 42 Bliss modernization assemblies you can add right in your own plant, keeping downtime and outside costs to a minimum. You can add important new press features to your old press at a fraction of the cost of a new press!

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increases Machine Capacity...

...and can ship to meet your needs

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Cross travel increased from 9" to 12"

Knee-to-column ways lengthened from 15" to 18"

The NEW Cross Travel Knee

Through a new knee, now available, cross travel is increased on Bridgeport Milling Machines to 12". Then, too, the knee-to-column ways have been lengthened from 15" to 18", assuring the maximum in rigidity and alignment.

Where more productivity is needed through greater capacity, these new features available in the "Bridgeport" at only a slight extra cost, will appeal strongly to shopmen everywhere. Toolmakers, moldmakers, pattern makers or production machinists will be well pleased with the greater productivity now made possible.

A NEW Optical Measuring System

A new direct-reading optical system has been developed which will greatly simplify and improve performance of the machine when used for jig boring.

SPECIFICATIONS

Longitudinal Travel—20"
Cross Travel—9" or 12"
Magnification—17 times
Reading Accuracy: direct—.0001"
Scales—100 lines per inch or 1 every .010
Glass covered scales for permanency
Electrical system—low, safe, 6 volts
Lateral adjustment of instrument—1"
Reading: catch fork system—*direct digit*
Reed Type Clamp System

New 3-Dimensional Hydraulic Tracing Machine

The new 3-dimensional Duplicating Machine received the highest praise at the recent ASTE Tool Show. Cylinders are built into special knee and saddle casting. 12" cross travel, one-shot lubrication system and chrome-plated ways are standard features on this machine.

●

WE CAN SHIP TO SUIT YOUR NEEDS WITH OUR EXPANDED PRODUCTION FACILITIES

For long life, hard-plated ways are available on all Bridgeport Milling Machines.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

All of these parts were designed to serve a specific function—at a lower cost. Some are made by customer-owned tools.

Pick a part! any part . . . any metal

Then ask us for an eye-opening quotation

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We offer a complete design-engineering service based on long experience and specialized production equipment, and are often able to suggest ways and means of using our stock tools to further cut costs.

Simply send us a sample, drawing or description of the parts you need, plus the quantity. The metal can be copper, brass, bronze, nickel silver, nickel, iron, steel, stainless steel or aluminum . . . and in any applied or plated finish you choose.

Send your inquiry to: The American Brass Company, Fabricated Metal Goods Division, Waterbury 20-A, Conn.

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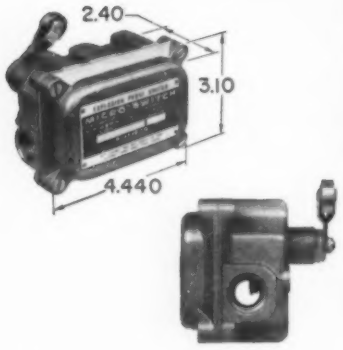
STOCK PRODUCTS: Write for catalog BG-1, showing a selection of more than 1,000 eyelets and seamless base pins of common sizes and styles, many of which are kept in stock for immediate shipment.

ANACONDA®

Multiple-Plunger Press Products

MICRO SWITCH Precision Switches

Compact high capacity UL listed explosion-proof switches



There is a wide variety of explosion-proof switches in the MICRO SWITCH precision switch line to help you boost productivity of equipment

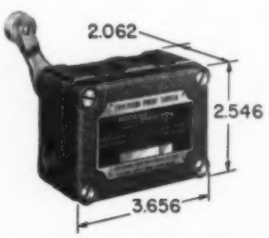
Here are a few examples of the many variations in mechanical and electrical characteristics, housings and actuators which are available in MICRO SWITCH explosion-proof switches. All feature rugged construction in sturdy housings, with a choice of mounting positions. Information on these precision switches is available from the MICRO SWITCH branch office nearest you.

Listed by Underwriters' Laboratories for use in hazardous atmospheres Class 1, Group C and D; Class 2, Groups E, F and G.

NEW

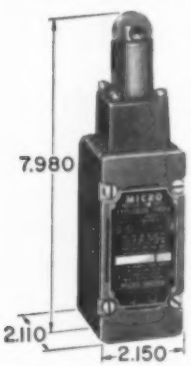
"EX1" SERIES

Series "EX1" switches have a conduit opening at both ends of the housing. This permits through wiring, which saves costs and space and improves appearance of the installation. Series "EX1" switches are available with four types of basic switches, with variations in electrical ratings, size of conduit openings and circuit arrangements. The switch illustrated has two ½-inch 14NPT conduit openings; capacity is 15 amps. 125, 250, 460 vac; ½ amp. 125 vdc; ¼ amp. 250 vdc. Contact arrangement is SPDT. Request Data Sheet No. 129.



"EX" SERIES, "AR" TYPE

Series "EX" switches have single conduit openings. They are available in a complete selection of actuators. There are 27 variations of the "AR" type alone, representing a wide choice of operating characteristics, electrical capacities and contact arrangements. This "EX" series switch is designed for cam or slide operation. Actuator is operated by clock-wise rotation, and it is adjustable through 360°. The roller is of non-sparking silicon bronze. Send for Catalog 83.



"ML-E1" SERIES

The "ML-E1" series of explosion-proof limit switches meets a wide range of requirements. For example, there are two-circuit double-throw double-break switches with a rating of 10 amps. 120, 240, 480 or 600 vac; 0.8 amp. 115 vdc; 0.4 amp. 230 vdc. The roller plunger actuator is for cam or slide operation. Sealed head can be rotated 90°. Wide choice of other actuators. Send for Catalog 83.

"ML-E1" SERIES

This series "ML-E1" switch has a roller lever actuator which can be positively locked at intervals of approximately 0.4° (870 positions). The actuator can also be adjusted to actuate the switch in the clockwise direction only, the counter-clockwise direction only, or in both directions. The head assembly can be faced in any of four directions and the roller arm may be reversed on the head. Send for Catalog 83.

MICRO SWITCH . . . FREEPORT, ILL.
A division of Honeywell
In Canada: Honeywell Controls, Ltd., Toronto 17, Ontario

The two-word name MICRO SWITCH *is not a generic term. It is the name of a division of Honeywell.*

Look for the name of MICRO SWITCH *Authorized Distributors in the Yellow Pages*

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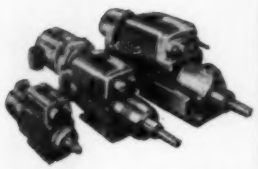
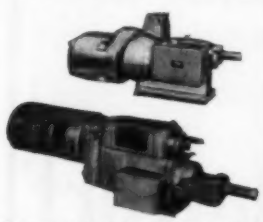
MICRO SWITCH PRECISION SWITCHES

THE COST CUTTING METHODS you need AT A PRICE you can afford



Air Hydraulic Drill Units

Circular Machine Base and Columns



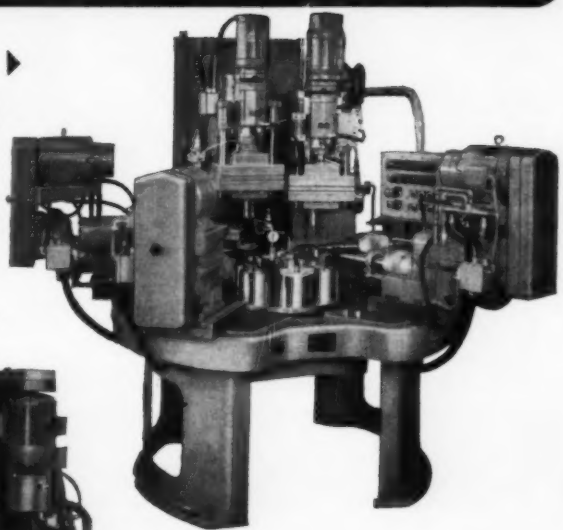
Automatic Lead Screw Tapping Units

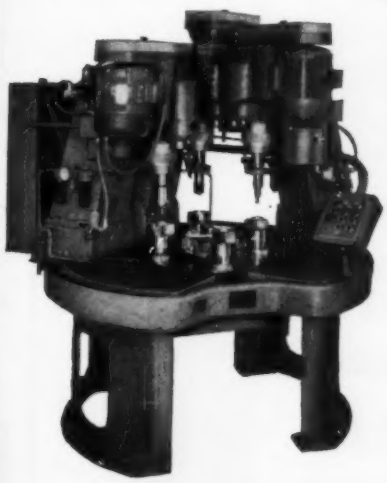
Rectangular Machine Base

EXAMPLE* ▶

A high speed indexing machine to drill and lead screw tap horizontal opposed pipe ports and two vertical mounting holes in stainless steel valve bodies at 320 parts per hour. Standard automatic self-centering Skinner air chucks hold parts.

Photo courtesy of The Skinner Chuck Company

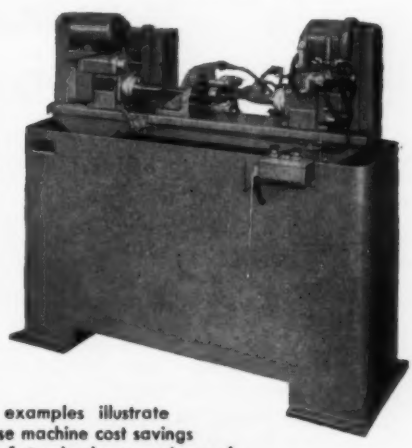




◀ **EXAMPLE***

Combination drill, bore and face plus two tapping operations in die cast regulator valve spring cages. Capacity: 450 parts per hour.

Photo courtesy of Watts Regulator Company



EXAMPLE* ▶

Double end opposed combination ream and face die cast piston plates to close tolerance. Simplified air-manual fixture loading permits production of 423 parts per hour.

Photo courtesy of Bendix Products Division Bendix Aviation Corporation

***Note**

The above examples illustrate single-purpose machine cost savings through use of standard pre-engineered components. The components, bases, columns, adapters and units as shown, are available for machines built by you or for you from Hartford Special.

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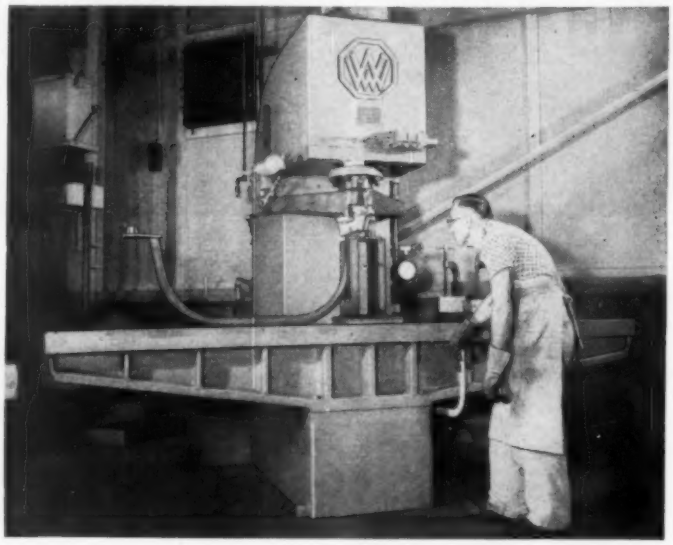
The press illustrated has 100 tons capacity, 120" x20" removable table, 20" daylight and 16" stroke. It is located in a plant of North American Aviation, Inc.



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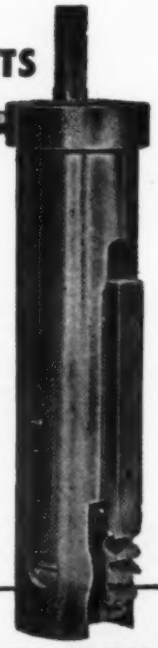

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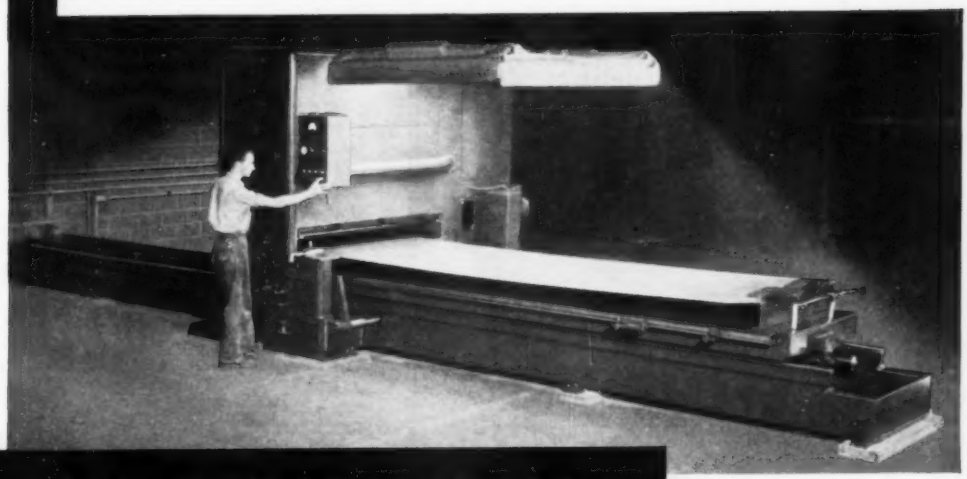
HILL Sheet and Plate polishing machine with reciprocating hydraulic table and vertical two roll head.



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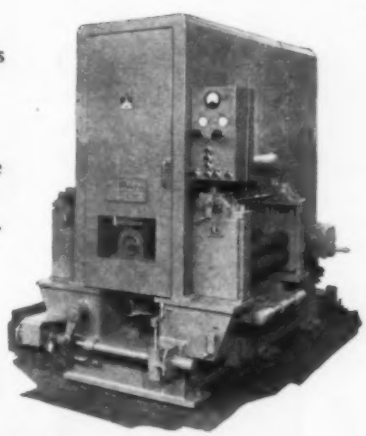

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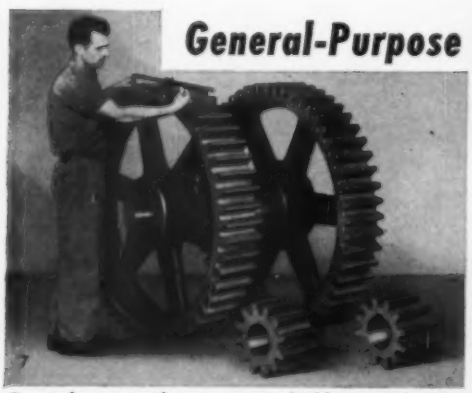

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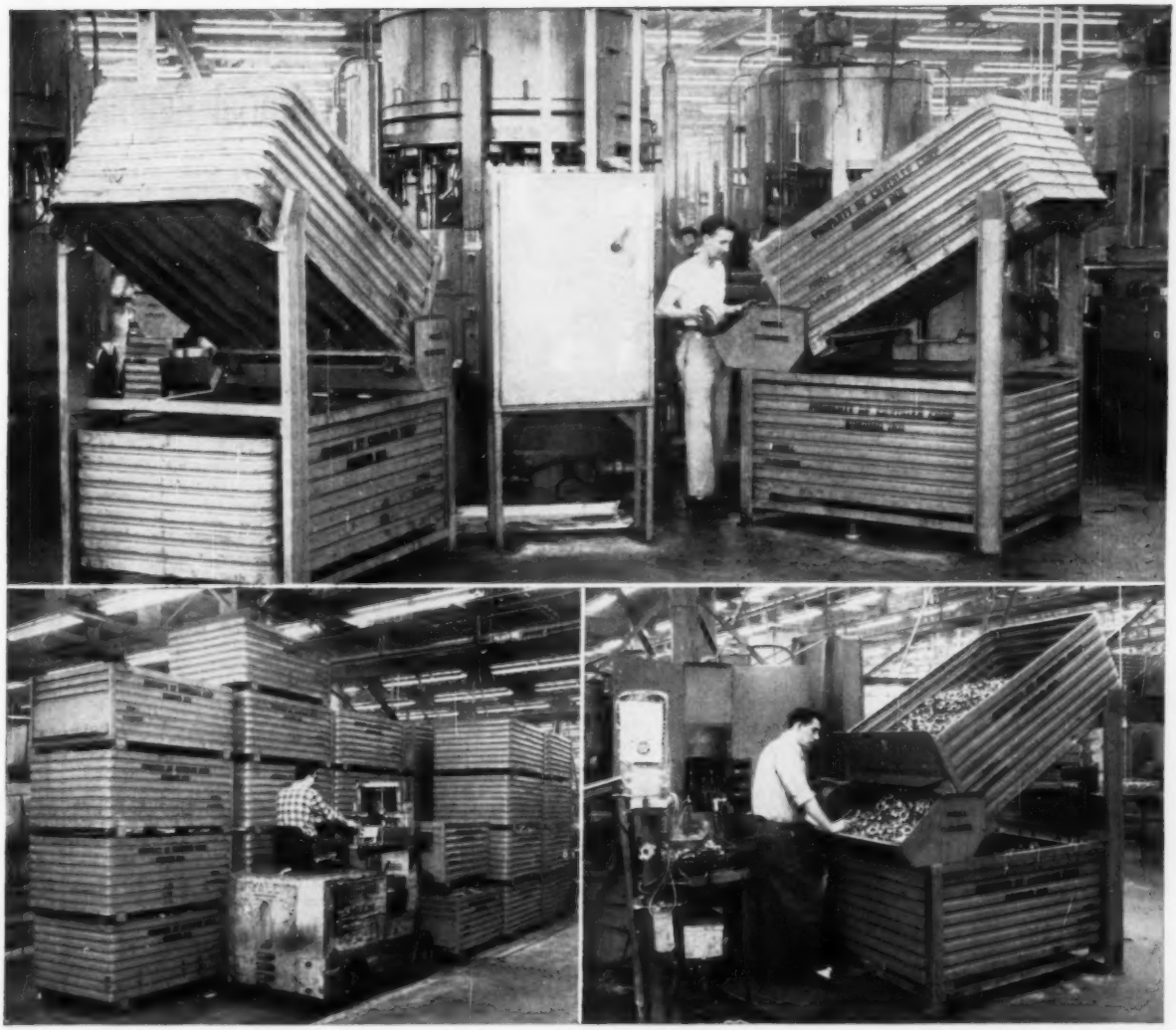

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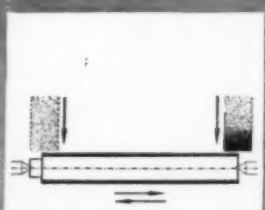

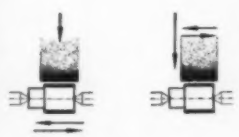

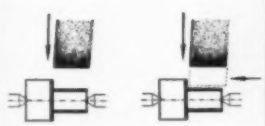

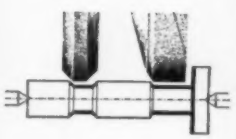

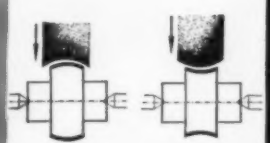

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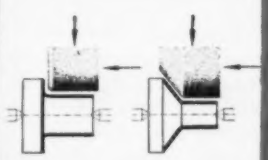

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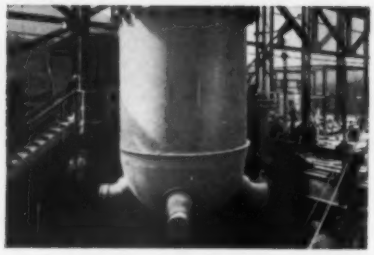

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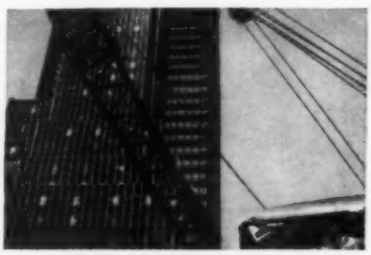

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* * *

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16" x 54" Centers Lodge & Shipley new 1951 12 spindle speeds, taper attachment.
20" Gould & Eberhardt Industrial Shaper, vise, front support, new 1947.
24" x 96" centers Boye & Emmes G.H. Lathe, 12 speeds, timken, late, taper.
32" x 252" American Pacemaker, new 1948, 40 HP AC motor, 18 speeds, hardened ways.
36" x 40" American Internal Face Plate Drive G.H. Lathe, 33' centers 2 carriages.
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GEAR SHAVER. GCC Red Ring. 8". late
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GRINDER, PLAIN. 20"x72" Landis. 1943
GRINDER, DISC. 30" No. 84A Gardner opposed. 1947
GRINDERS, INT. 72A5 Heald Univ. 1943
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No. 645A3 Fellows, vee belt drive
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No. 72B Fellows, 1945
No. 75 Fellows, H.S., m.d.
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INDEX TO ADVERTISERS

This index is published as a convenience to the readers. Every care is taken to make it accurate, but American Machinist assumes no responsibility for errors or omissions.

	Page
Aget Manufacturing Company	188
Allison-Campbell Division American Chain & Cable Co., Inc.	141
Aluminum Company of America	134
American Brass Company	183
American Broach Division Sundstrand Machine Tool Company	53
American Chain & Cable Co., Inc. Allison-Campbell Division	141
American Sip Corporation	196
American Steel & Wire	55
American Tool Works Co.	51
Armco Steel Corporation	80
Armstrong Blum Mfg. Co.	46
Armstrong Brothers Tool Company	40
Baker Bros., Inc.	132
Barber-Colman Company	36-37
Baush Machine Tool Company	169
Bay State Abrasive Products Co.	24-25
Bearings, Inc.	131
Behr-Manning Corp.	61
Bellows Company Div. International Basic Economy Corp.	133
Bliss Co., E. W.	181
Bridgeport Machines, Inc.	182
Brown & Sharpe Mfg. Co.	57
Buffalo Forge Co.	135
Bullard Company	79
Burgmaster Corporation	70
Capco Products Div., Columbus Auto Parts Co.	106
Capewell Mfg. Co.	60
Card, S. W. Division Union Twist Drill Co.	44
Carlton Machine Tool Company	68
Century Electric Company	179
Chandler Tool Company	188
Cincinnati Grinders Incorporated	16-17
Cincinnati Milling Machine Co.	4-5
Circular Tool Company	164
Cities Service Oil Co.	42

(*Continued on page* 196)

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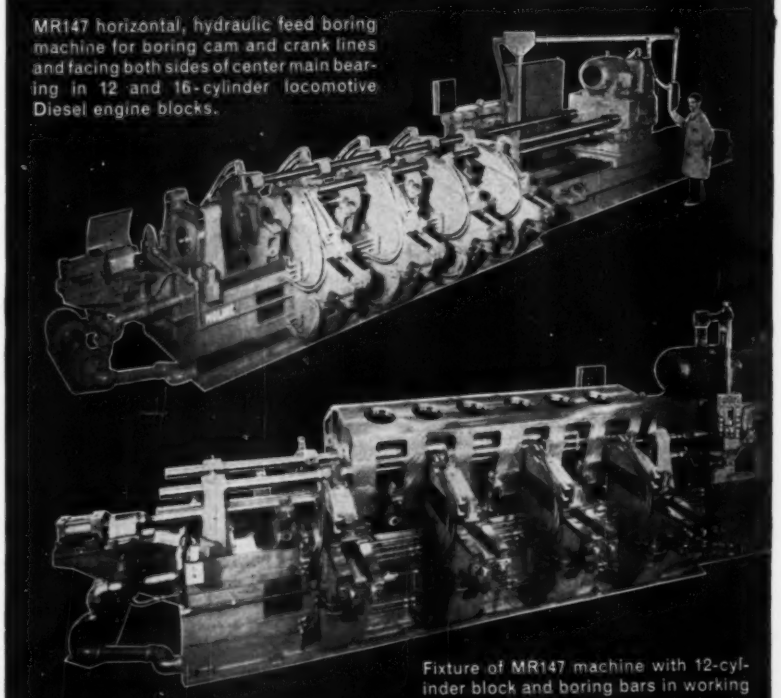

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INDEX TO ADVERTISERS

(*Continued from page* 195)

	Page
Cleveland Instrument Co.	172
Columbia-Geneva Steel	55
Columbus Die-Tool & Machine Co.	139
Cone Automatic Machine Co., Inc. (Pilot Division)	48
Consolidated Machine Tool Div., Farrel-Birmingham Co., Inc.	158
Continental Tool Works Div. Ex-Cell-O Corp.	66
Copperweld Steel Company	110
Covel Manufacturing Company	200
Crucible Steel Co. of America	170
Cushman Chuck Company	147
Davis & Thompson Co.	199
Delta Power Tool Division Rockwell Mfg. Co.	157
Detrex Chemical Industries, Inc.	138
Detroit Reamer & Tool Company	166
Dixie Bearings, Inc.	131
Dreis & Krump Manufacturing Co.	136
Eastman Kodak Co. Apparatus Division	167
Eaton Mfg. Co. Automotive Gear Division	143
Economy Engineering Co.	172
Eisler Engineering Co., Inc.	188
Electronic Control Systems Div. Stromberg Carlson Co. Div. General Dynamics Corp.	180
Erickson Tool Company	174
Erie Foundry Company	178
Ex-Cell-O Corporation	66
Federal Products Corporation	39
Fellows Gear Shaper Company	6-7
Filmsort Company Div. Miehle-Goss-Dexter, Inc.	186
Firth Sterling, Inc.	112
Fosdick Machine Tool Company	26-27
Gear Specialties, Inc.	54
Geometric-Horton	3rd Cover
G & L Hypro Div. Giddings & Lewis Machine Tool Co.	14-15
Gisholt Machine Company	34
Gleason Works	3
Goss & de Leeuw Machine Company	130
Grant Mfg. & Machine Company	199
Gray Co., G. A.	28-29
Gulf Oil Corporation	56

INDEX TO ADVERTISERS

	Page
Hanson-Whitney Company Division of Whitney Chain Company	160
Hardinge Brothers, Inc.	33
Hartford Special Machinery Co.	185
Heald Machine Company Sub. Cincinnati Milling Machine Company	2nd Cover
Hill Acme Company Acme Machine Division	187
Horton Chuck	3rd Cover
Ingersoll Milling Machine Co.	151
Inland Steel Company	155
Jahn Manufacturing Co., B.	128
Jones & Lamson Machine Co.	38
Kalamazoo Division New York Air Brake	145
Kearney & Trecker Corporation	177
Kent-Owens Machine Company	72
Landis Machine Co.	10-11
Landis Tool Co.	12-13
LaPointe Machine Tool Co.	64
LeBlond Machine Tool Co., R. K.	20-21
Linley Brothers Co.	190
Lodding, Inc.	197
Lodge & Shipley Co.	43
Logansport Machine Co., Inc.	41
Lovejoy Tool Co., Inc.	156
M.B.I. Export & Import Ltd.	152
Metallurgical Products Dept., General Electric Co.	8-9
Micro Switch Division of Honeywell	184
Miller Electric Mfg. Co., Inc.	190
Moline Tool Company	195
Monarch Machine Tool Co.	47
Motch & Merryweather Machinery Co.	30-31
National Electric Welding Machines Co.	108
National Machine Tool Co.	186
National Tube	55
New Jersey Zinc Co.	50
Nicholson File Co.	137
Noble & Westbrook Mfg. Co.	62
Nogren Company, C. A.	150
Northfield Foundry & Machine Co.	195

(*Continued on page* 198)

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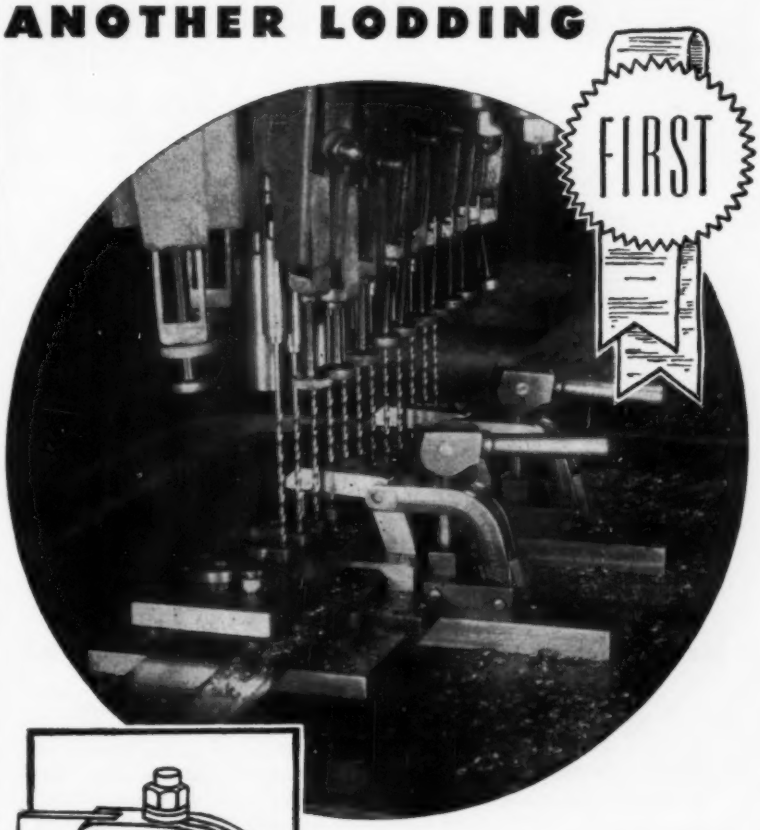

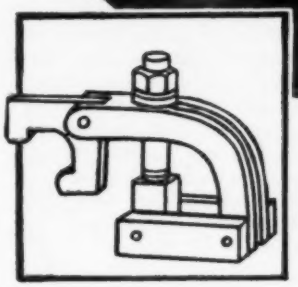

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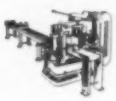

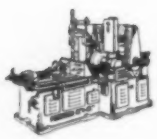

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INDEX TO ADVERTISERS

(*Continued from page* 197)

	Page
Norton Company	18-19, 49
Oakite Products, Inc.	142
Ohio Crankshaft Co.	149
Olivetti Corp. of America	191
Pacific Industrial Mfg. Co.	35
Peerless Machine Co.	198
Pipe Machinery Co.	127
Powell Pressed Steel Co.	189
Randall Co., Inc., Frank E.	197
Reed Rolled Thread Die Co.	63
Rockford Machine Tool Co.	58-59
Roto-Finish Co.	144
Ruthman Machinery Co.	148
Sciaky Bros., Inc.	176
Shore Instrument & Mfg. Co., Inc.	188
Springfield Machine Tool Co.	82
Square D Co.	125

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INDEX TO ADVERTISERS

	Page
Stahl Gear & Machine Co.	188
Standard Oil Co. (Indiana)	153
Sundstrand Machine Tool Co.	52
Sun Oil Co.	129
Tannewitz Works	188
Tennessee Coal & Iron	55
Texas Company	76
Thompson Grinder Co.	171
Timken Roller Bearing Co.	4th Cover
Tomkins-Johnson Co.	105
Torit Manufacturing Co.	164
Torrington Mfg. Company	146
Union Twist Drill Co.	45
United States Steel Corp.	55
United States Steel Export Co.	55
United States Steel Supply Div. U. S. Steel Corp.	55, 74
U. S. Tool Co., Inc.	32
Universal Engineering Co.	165
Valvoline Oil Company Div., Ashland Oil & Refining Co.	140
Van Keuren Co.	168
Vanadium-Alloys Steel Co.	175
Vascaloy-Ramet Corp.	123
Vickers, Inc. Div. of Sperry-Rand Corp.	163
Warner & Swasey Co.	22-23
Wean Equipment Corp.	161
Weldon Tool Co.	173
Wells Mfg. Co.	154
Wheelock Lovejoy & Co., Inc.	162
Williams White & Co.	186

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 194

EQUIPMENT

(Used or Surplus New)
For Sale 193-194

ADVERTISERS INDEX

Eastern Machinery	194
Electric Equipment Co.	193
Falk Mill Supply Co., Inc.	194
Hyman & Sons, Joseph	193
McDonald Machinery Co.	193
Miles Machinery Company	193
Sal Metal Products Co.	193
Stump & Co., Weldon F.	193
Tait Manufacturing Co., The	193

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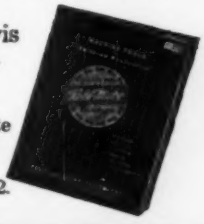

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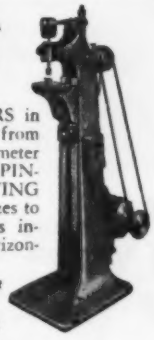

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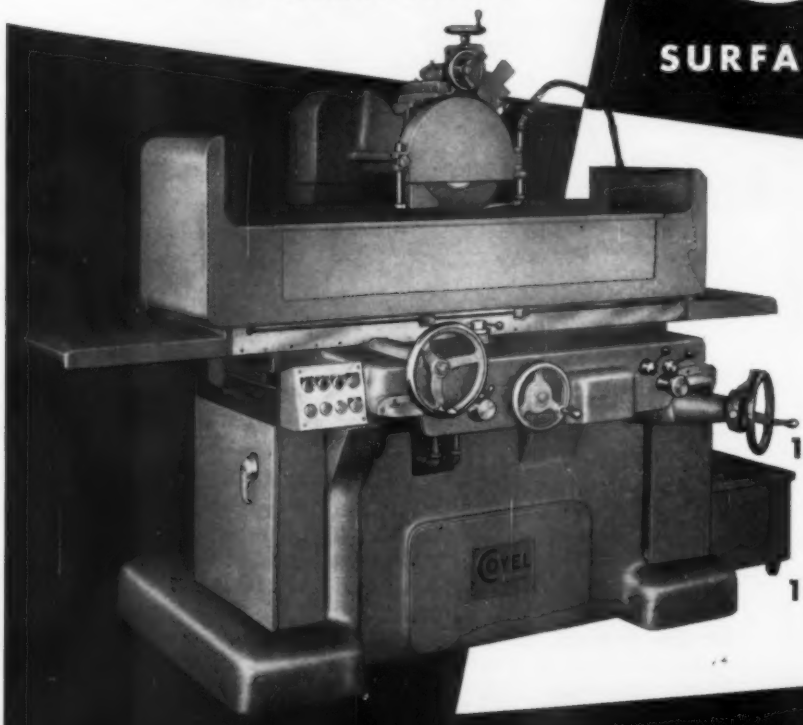

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GRINDS WORK
8" x 24" x 18" high!

COVEL 60
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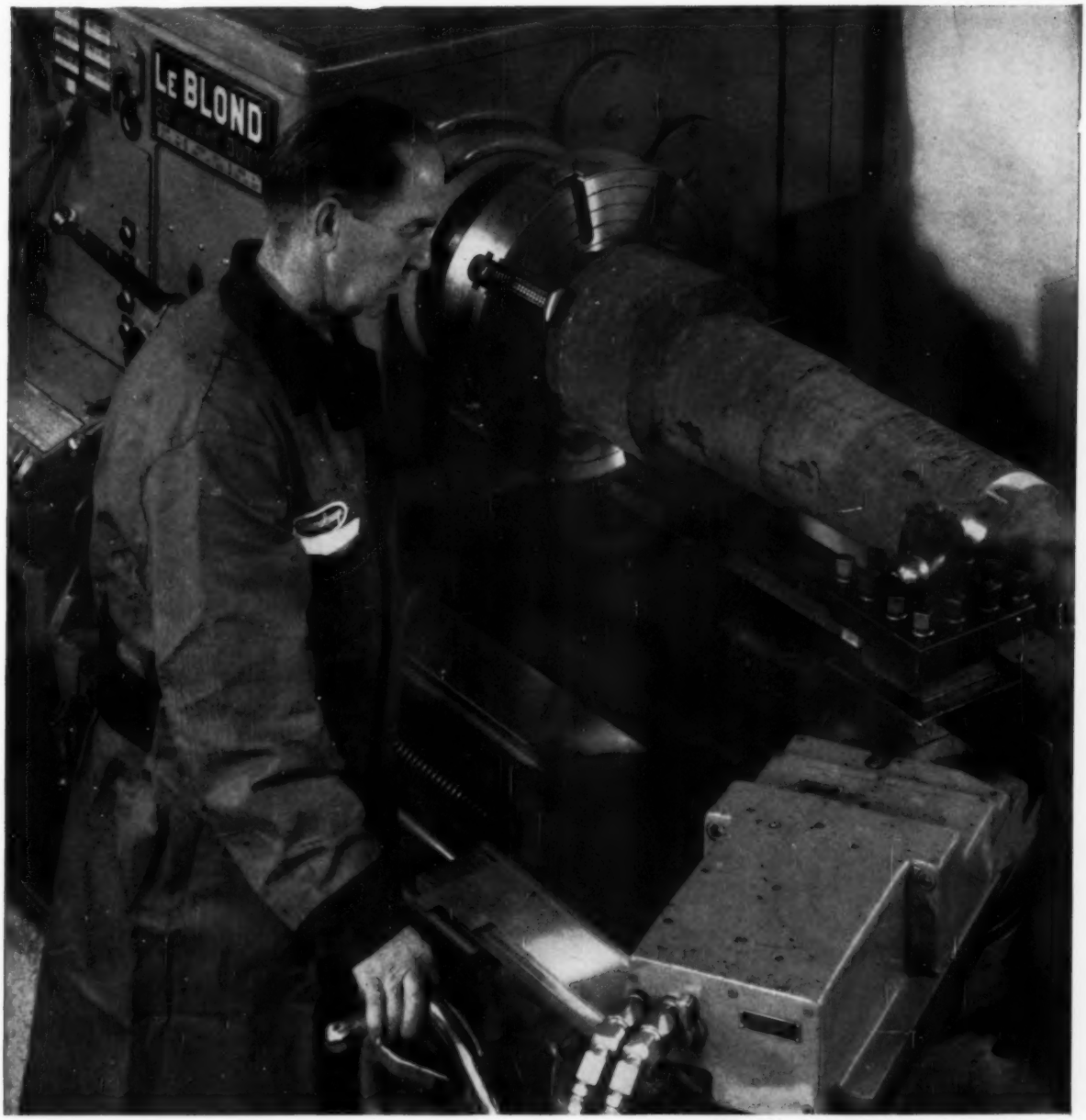

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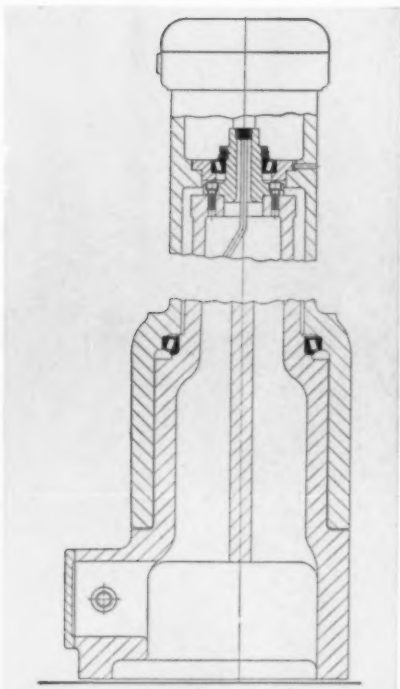

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